ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

APRIL 10, 1948

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ELECTRICAL WORLD

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Shown in construction, this GE 6250-kva synchronous generator is destined for use with a 6400-hp diesel engine. The stator frame measures 20 ft in diameter. When completed, the machine will weigh close to 63 tons

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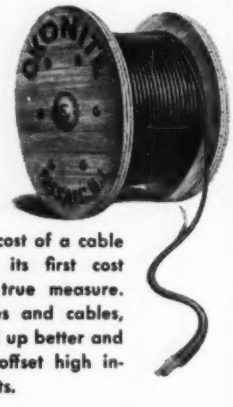
Aluminum-Conductored Rolling Mill
Installation of Aerial Cable by Spinner

why Okonite continues to use UP-RIVER FINE PARA RUBBER for cable insulation



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THE BEST CABLE IS YOUR BEST POLICY

APRIL 10, 1948

They Are Playing For Keeps

POLITICIANS are predictable. So last week's move by the TVA-ers was not unexpected.

TVA, remember, wants Congressional approval to build a steam-electric plant at New Johnsonville, Tenn. Evidently the ethical and economic grounds on which the bid has been based thus far are seen by New Johnsonville advocates to be as weak as ELECTRICAL WORLD indicated in this page on March 27. That must be why the war emergency is dragged in as justification for the move.

President Truman has ordered a survey of the extra electric power necessary to meet defense needs. Arthur M. Hill, chairman of the National Security Resources Board, and Dr. Edwin G. Nourse, chairman of the Council of Economic Advisors, are to head up the survey. And who do you suppose is to assist as a power expert? None other than Gordon Clapp, TVA chairman.

Mr. Clapp's statements to the press after the initial meeting of the group with the President are illuminating. After speaking of the "emergency program for preparedness"—involving the nation as a whole, we assume—he said he was "deeply concerned" about the power situation in the Tennessee Valley, where power consumption is much higher than at any time during the war. His talk with the President, he continued, concerned only the Tennessee Valley, but he thinks that a similar power situation exists in other parts of the country.

He will turn over information to Dr. Nourse, whose group of economists this week is to make its first quarterly report on the state of the national economy. It was in another of these Nourse studies, you may remember, that the $40-a-vote tax reduction scheme was promulgated. If the necessity for New Johnsonville as a defense measure is not one of the topics covered in a subsequent report, we'll miss our guess.

Steam-generated kilowatts inevitably must flow into the systems in the Tennessee Valley. With by-product natural resource power about at its ultimate, there would be a lamentable halt to growth in that region without additional power facilities. Yet we believe the people and the Congress should consider carefully the auspices under which that electricity is made available.

They should consider the lack of ethical base for the TVA proposal. They should weigh all the consequences of this further breakdown of our historical concepts of the relationship between people and government—the "sapping of solemn creeds with solemn sneers."

They must decide if discriminatory subsidies are as illegal as they are immoral, whether the people of other regions must pay for the building of economic disadvantage for themselves.

These are momentous decisions. They should be arrived at in an atmosphere of deliberate calm. Yet, apparently, Congress is to be presented with the necessity for a quick decision, a hurry-up action, to the tune of drumbeats.

The ends to which the advocates will go to effect this new and improper step for TVA is a measure of its ideological importance.

He Orders Best Who Orders

COUNTRIES SOUTH of the border which want to industrialize have been caught short. The problem: A squeeze play between dollar shortages and delivery dates.

To industrialize, they need heavy electrical equipment. They must buy it from the United States. So the pressure mounts on American manufacturers, already hounded to produce the greatest amount of load-producing machinery ever called for. Latin Americans needing this equipment, then, ought to get their orders in early.

But the squeeze comes from the other side of the fence. A dollar shortage is plaguing nearly every country. Immediately after the resumption of U. S. nonmilitary export trade, these countries began spending their accumulated dollars. Far from all of it went into capital goods. Inevitably, a dollar shortage arose. In taking logical steps to stop the drain, they blocked dollars for many imports, including electrical equipment.

By so doing, these countries are blocking themselves right off the order boards of the U. S. electrical manufacturers.

This squeeze play can be worked out. Marshall Plan nations will not be troubled because Latin American competitors have blocked themselves out of the competition for U. S. electrical equipment. Nor will U. S. electric utilities, with big expansion programs underway, be sorry about the situation. But these Latin American countries which want and need power can solve their own problem by releasing dollar exchange so that orders can be placed now. It's all a matter of getting in line. The earlier in line, the shorter the wait for equipment which can make industrialization real.

Take a Bow

CREDIT WHERE credit is due. That's our motto. So we give an approving nod to the Tennessee Valley Public Power Association for its choice of a place to hold its 1948 convention.

This is the truth, so help us. The mayor of Huntsville, Ala., opening the TVPPA meeting with the traditional address of welcome, actually spoke in electrical terms and as if he knew what they meant. Questioned later, he said he was not an electrical man and denied his speech had been written for him. It was just, he asserted, that for such occasions he had made it a practice of doing a little preparation beforehand to key his welcoming remarks to the interests of the welcomees.

We've sat and suffered hundreds of times under the stereotyped platitudes and frayed cliches ladled out by mayors or second assistant commissioners of public works representing them. It was a refreshing shock to hear circuit breakers, transformers, kilowatts, distribution, transmission and many other electrical terms used by a politician in a way to show he really knew what he was talking about.

It's Really Simple

"FRENCH REDS Hamper Drive to Cut Prices," says a recent headline. It develops, among other things, that the French government wants to cut back on some rather substantial power rate increases of last January. But the nationalized power system is in the red and the government has had to advance 28,000,000,000 francs for service in France and Algeria. The problem, this story says, is to reduce "overly burdensome rates" without a revival of state subsidies.

There's a simple way to do this. True, it would be a hard job. But it's a proven way for any power system, regardless of ownership. First, you find out the costs of service. Then you do everything you can to cut the costs. As costs go down, you lower rates. Then people use more energy, which cuts costs and permits further reductions. It's really simple, even though it's pretty hard to get started.

The classic example of how well it works exists in the United States. And there's no iron curtain around the experience we've compiled.

Sooner Than We Think?

IT'S GOING TO BE a quarter of a century before atomic-electric power can do anything more than supplement conventional sources. This estimate has become standard, recently. But some wonder whether this lengthy period isn't really a lot shorter, so far as the electric utility business is concerned.

Today, and for some years to come, these companies are selling debt securities by the barrel. Generally, these run for terms which won't expire before the advent of atomic-electric power. Under present practice, they are only refunded, rarely retired. Meanwhile, the government is pouring out development funds for atomic-electric power, again by the barrel.

When it comes, nuclear power probably will work broad changes in the industry—and it will have been bought and paid for by the federal government. It won't wipe out the industry. But it could imperil security holders, particularly equity holders. This possibility will be particularly real if none of the overlying debt is retired.

Doesn't this raise some serious questions in the minds of utility leaders? Suppose such a belief were fixed in the minds of a number of major sources of new utility capital. That wouldn't help a bit in achieving the financing job which must be done.

It may be that the industry, should it find this premise valid, ought to talk at length with the Atomic Energy Commission. Certainly, AEC has at least two members who know finance well. No one is going to recommend captiously an abrupt reversal of the financing pattern upon which this industry has grown great. But this may be one of those atomic age problems which has to be grappled with now, not a generation hence.

NEWS OF THE ELECTRICAL WORLD

The Electrical Week

The Power and Utilities Section of NSRB got down to business this week in Washington. A preliminary program was mapped out with the aid of industry representatives . . . At Greenville, Miss., last week the ALMNO system of Electric Bond & Share with much fanfare launched its Middle South Development Program . . . The House has passed the Deficiency Appropriation Bill. AEC got a big lump of the money for its construction program . . . American industry is using a huge block of power—can use even more in the future—Midwest Power conferees were told at Chicago . . . California enjoyed heavy rains, but the power problem still remains . . . And in Chicago, a program to sell more electric kitchens was previewed at the sales meet of EEI.

. . .

A Senate committee reports that electric service in sparsely settled areas may, in the near future, be most economically supplied by "home generating units." It urges research to develop the needed facilities.

. . .

When the miners get back to work, the coal industry, can start striving to meet its 1948 goal—production equal to that in 1947. At the end of March, bituminous output was 16.3% lower than that for the corresponding 1947 period—and fast dropping further behind.

. . .

A Boston man is expected to fight the Electric Power & Light dissolution plan which gets a hearing April 14. But the feeling is that the plan will be accepted anyway.

. . .

Inter-utility cooperation at operating levels is expanding into the same cooperation on less-tangible matters. The ALMNO systems' Middle South Development Program is a direct outgrowth of the operating integration of the four properties.

. . .

Output is going down faster than at anytime since the Japs quit fighting. The coal miners and lack of water for hydro generation get the blame.

Considerable standardization of power equipment components is practiced by electrical manufacturers. Big cost savings are one reason. Another is that, increasingly, smaller purchasers, particularly municipals and REA's, want products which will require a minimum of engineering on their part.

. . .

Today's pinch in power transformers is penalizing not only utilities, who are accustomed to planning years in advance, but, more critically, industrials, who plan, ordinarily, on a much shorter basis.

. . .

The bituminous coal industry has put up $250,000 for an engineering program to design a machine that will mine coal cheaper and faster. The program's goal is a machine that will both cut coal "off the solid" without the use of explosives and load the coal continuously onto a conveyor or into mine cars.

. . .

Operators of Britain's pulverized-fuel plants look hopefully to the cyclone furnace experiments in Chicago. They are disturbed by the high proportion of the poorest quality fuel imposed on them.

. . .

Tax collections on electric appliances rose sharply in 1947 over 1946 yields. For example, light bulbs and tubes yielded $24,000,000, up about 25 percent; radios, phonographs, components, etc, $78,000,000, almost double 1946. As Washington's Electric Institute puts it, "somebody must be selling these things."

. . .

Only half the British grid's war-time faults were due to armed action. Defense caused 5.5 times as many as offense. Barrage balloons caused four out of five attributed to the defense.

. . .

Gossip that the Middle South Development Program aims at taking over REA cooperative facilities isn't true. Hamilton Moses, Arkansas Power & Light president, told reporters instead, that REA co-ops have done a "magnificent job" in helping area development.

NSRB Power and Utilities Section Maps Out Preliminary Program

THE POWER and Utilities Section of the National Security Resources Board, peace-time version of the Office of War Utilities, formally opened for business this week (Apr 5).

Though still in the process of organization, the new NSRB unit met with a group of utility industry representatives and mapped out a preliminary program. First activities scheduled by Chief Consultant Ed Falck were studies of the capacity and requirements of power systems, and of the availability of heavy equipment.

This week's meeting, called by NSRB Chairman Arthur M. Hill, brought more than two dozen officials of private and public power systems to Washington. This group was composed largely of the industry advisors who cooperated during the war with OWU. The same men probably will form the nucleus of a power industry advisory body for the new Falck organization.

They included the following:

K. M. Irwin, Philadelphia Electric Co; William A. Lyons, New York State Electric & Gas Corp; Philip Sporn and V. M. Marquis, American Gas & Electric Service Corp; E. W. Morehouse, General Public Utilities Corp; Walker Cisler, Detroit Edison Co; Charles Collier, Georgia Power Co; Alexander Bailey, Commonwealth Edison Co; James B. Black, Pacific Gas & Electric Co; H. P. Sedwick, Public Service Co of Northern Illinois; William S. Peterson, Los Angeles Department of Water & Power; John M. Orr, Duquesne Light Co; Donald C. Luce, Public Service Corp of New Jersey; Chandler W. Jones, New England Electric Systems, and these government representatives:

Gordon Clapp and G. O. Wessenauer, TVA; Walton Seymour, Department of Interior; Barclay J. Sickler, Bonneville Power Administration; Nelson Lee Smith and E. Robert de Luccia, FPC; assistant Secretary of Interior C. Girard Davidson, and REA Administrator Claude Wickard.

Agenda of the meeting included discussions of the need, if any, for government assistance in the industry's power plant expansion program, the industry's fuel problems, present and future power requirements, effects of Daylight Saving Time on industry operations, impact of the European Recovery Program on domestic utilities, and emergency mobilization planning.

The group also discussed the future staff of the NSRB Power Section, now composed solely of Falck and Paul B. Valle, another OWU veteran. Industry men promised to cooperate.

PRESIDENT TRUMAN, seated left, confers with his Inquiry Board on the coal strike. Seated at right is the Board's chairman, Judge Sherman Minton. Standing are the other Board members, George W. Taylor, left, and Mark Ethridge

Coal Situation Worsens for Electric Companies

The nation's soft coal miners were still on strike at midweek. When they intend to return to work few would predict. There was no proof that the predictions of the few were right.

In the meantime, the coal situation grew worse for the electric utilities. In an affidavit supporting the Justice Department's claim for a permanent injunction against John L. Lewis and other UMW officials, Interior Secretary J. A. Krug stated that without additional coal supplies, 36% of the electric power utilities would be shut down, or their operations curtailed, within 30 days. Within 60 days, it would hit 67% of them.

The situation as to individual power plants was given in an affidavit by David Bruce, acting Secretary of Commerce. He said that of 622 electric power utility plants, 114 could not operate more than 15 days, and another 135 could not operate more than 30 days.

Coal supplies were less favorable this year than they were at the time of the 1946 spring coal strike. With 58,531,000 tons in the hands of industrial consumer and retail dealers on Apr 1, 1946, the impact of the coal strike on the economy became crucial in less than two months, according to Krug. As of Mar 1, coal supplies totaled much less —48,472,000 tons—despite greater demand.

Even so, the nation's electric utilities were in better shape to face a prolonged coal strike than other industries. Stocks of coal on hand at utility power plants had dwindled somewhat, but most major companies still had a month's supply or more on hand.

Virginia Utilities Hard Pressed

Among the harder pressed were the Virginia utilities, who were scheduled to meet with the State Corporation Commission on Apr 9 to discuss their fuel problems. Virginia Electric & Power Co, major power supplier of the state, estimated its stocks of both coal and oil as sufficient to carry the company for about three weeks.

However, the state government reportedly was considering early action should the mine shutdown continue. It was predicted that these steps would take the form of an order by the Corporation Commission limiting power use by industrial and commercial consumers and urging voluntary reduction of use by residential customers. The state also was reported contemplating seizure and allocation of coal stocks now on hand.

Middle South Development Program Opened by 4 ALMNO Companies

By Richard N. Larkin

GREENVILLE, MISS.—First notes of a holding company's swan song echoed here last week. They sounded a fanfare for a new departure in the electric utility industry's development of a territory.

They came as four operating companies—Electric Bond & Share's integrated ALMNO system—opened their Middle South Development Program. At Greenville, the emphasis was entirely on the local companies, Arkansas Power & Light Co, Louisiana Power & Light Co, Mississippi Power & Light Co and New Orleans Public Service, Inc. But their participation came as a result of long missionary work—two years of it—by Electric Power & Light Co, an EB&S sub-holding company, whose plan for disintegration goes to hearing next week.

Program Has New Twist

Sponsored by the four companies, the Middle South Development Program aims at broad social and economic development of the rich, three-state territory they serve. As such there's little new about it, others similar to it have been practiced individually by many electric companies—for many years. The new twist to the Middle South program comes from:

1. The linking of three states into a unified development plan.
2. The active participation of a holding company.

Also striking in the Middle South program is the extent to which it will be concerned with non-commercial area development. Its sponsors brought educators, bankers, civic officials, public health experts, industrialists, and others to Greenville for the kick-off of their program. Ultimate goal of the four-company program, to be sure, is more and ever more business for the ALMNO companies. But they profess conviction that they won't get the new business without intensive development of the region's churches, schools, recreational facilities, transport, and everything else. Such development, then, is as fully a goal of the Middle South program as new industrial load.

President Hamilton Moses of AP&L told correspondents that an Arkansas program which aimed at bringing new industries to the state has been at once successful and illustrative of the need for broader promotion. In three years, he said, that one-company program brought 961 new industries or major expansions to Arkansas, with an investment of $90,000,000.

"Then we found that so successful a program wasn't enough," Moses said. "We found we had to have schools, hospitals, playgrounds, and everything else which an increasing and prosperous population requires. Those are the things we've got to do if we're going to develop Arkansas, Mississippi, and Louisiana, and that's what we expect the Middle South Development Program to get done."

Sponsoring companies, Moses said, want to furnish the necessary leadership that any such program requires. Beyond that, the results will have to be achieved locally.

The formal Middle South program started flamboyantly enough. Half a hundred correspondents from major newspapers and magazines were flown into Greenville, April 1, for the ceremonies. Two governors and the representatives of two more spoke at dedicatory ceremonies. Presidents of three sponsoring companies met the press to explain the program. The usual ceremonies of any such promotion were held in full measure. For the correspondents—most of them from Washington—there was an added attraction. This came in the opportunity to query the governors, including Mississippi's Fielding Wright, as to the probable outcome of Dixie's revolt against the Truman Administration.

Moses, and Presidents Rex I. Brown of Mississippi Power, and A. B. Paterson of New Orleans Public Service, explained their sponsorship of the program. They began by denying that $1,000,000 has already been set aside for the four companies as a working fund. Actually, they said an additional $115,000 has been budgeted for the first six months, over and above the customary development funds normally budgeted by these companies. The extra funds will go primarily into a national advertising program and into the establishment of a central office, probably at New Orleans, to handle the Middle South program.

Specific plans for the immediate future of the program are few, these men told the correspondents. It was hoped that the educators and others brought to Greenville would turn up with suggestions in their respective fields from which a going program could be evolved.

Moses and Paterson explained that the Middle South program really represents an alliance among four companies to do collectively what each had been doing alone for as long as a quarter of a century.

"We're Trying to Do Something"

"For entirely too long," Moses asserted, "the South has been called the nation's No. 1 economic problem. We're trying to do something about it."

Representatives of the program will visit all possible municipalities in the three states. They will try to persuade local officials to blueprint the futures of their towns for as far ahead as possible. Municipal officers are anxious to do this, Moses told ELECTRICAL WORLD, but don't know quite how. The Middle South program will do all it can to show them.

President Edgar Dixon of Electric Power & Light attended the Middle South dedicatory program at Greenville, but he took almost no part in the program. It was learned however that Dixon has been a driving force behind the entire program since work on it started two years ago. Presently, EP&L is making no financial contribution to the program. When its dissolution plan, filed recently with the Securities and Exchange Commission and set for hearing April 14, has been acted upon, EP&L or its successor company may very well take an active financial part, it was learned.

That the Greenville dedication came as EP&L's dissolution plan was filed with SEC was purely coincidental, all officials agreed.

Municipal Seeks Aid

The Rehabilitation Committee of Coatesville, Ind., is appealing for aid to rebuild its utilities and shattered streets. The city needs $100,000. A tornado struck the city on Good Friday and damaged beyond repair the municipal distribution system. Last Sunday, the committee collected $13,000 from sightseers.

Silt Study at Hoover Dam

The Navy has sent personnel and equipment to Hoover Dam to make a survey of silt conditions in Lake Mead behind the dam. Silting is not only cutting down the storage capacity of the dam but also is important to farmers whose lands are being washed into the river feeding the lake.

House Votes AEC $150,000,000 for Expansion, Adds to REA Fund

THE ATOMIC ENERGY Commission, Army Engineers, Bureau of Reclamation, Rural Electrification Administration, and Bonneville Power Administration are slated for additional construction funds for expenditure before July 1. The new money is contained in the Deficiency Appropriation Bill passed Apr 1 by the House.

The bill carried a total of $346,000,000 in cash and $154,000,000 in contract authorizations for a number of Federal agencies. Largest slice of the latter funds went to AEC, which was authorized to let contracts for $150,000,000 in new construction and equipment.

The new AEC grant, which is expected to win swift Senate approval, will permit the agency to commit a total of approximately $260,000,000 for construction during the current fiscal year. Congressional leaders promised to award AEC additional funds during fiscal 1948 when they acted on the agency's annual appropriation last summer.

Meanwhile, AEC announced that it has accelerated its $1,100,000,000 construction program and could enter into contracts for the deficiency authorizations before June 30. Construction obligations to be incurred during the year by each of the Commission's five operating centers on the basis of the new funds follow:

New York—An estimated $27,068,160 in contracts will be let this year on $48,109,944 of construction planned over a three-year period. During fiscal 1947, $1,356,784 was put under contract. The 1948 estimate includes $21,734,000 for new research facilities and $5,334,160 for production and processing plant.

Santa Fe—Projects evaluated at $74,517,340 will be put under contract this year. The full construction program calls for expenditure of an estimated $227,818,014, of which $68,802,652 was awarded prior to June 30, 1947. The 1948 program includes $43,066,655 for production and research facilities and $31,450,685 for housing and community development at Los Alamos and subsidiary stations.

Oak Ridge—During fiscal 1948, contracts totaling $30,562,167 for construction will be let. Projects now programmed will cost a total of $241, 771,218 with $22,791,192 committed through fiscal 1947. The 1948 schedule includes $12,714,125 for production plant and research facilities, and $17,848,042 for housing and community construction.

Hanford—An estimated $119,768,968 will be put under contract in fiscal 1948 as part of a $294,357,241 expansion program. Of the latter total, $174,588,273 had been awarded by the end of fiscal 1947.

Chicago—Construction contracts estimated at $10,254,000 will be let this year as part of the $70,688,453 expansion program. By the close of fiscal 1947, $3,484,700 had been awarded. The funds are being spent at three laboratories, in Du Page County, Ill.; Berkley, Calif., and Ames, Iowa.

REA was authorized to make additional loans totaling $175,000,000. The deficiency grant increased the agency's lending fund total for the fiscal year to $400,000,000, the exact amount approved by the House recently for REA loans during fiscal 1949.

The Reclamation Bureau received $700,000 to continue work on Anderson Ranch Dam in Idaho, and $800,000 for the Payette Division of the Boise project. The Army Engineers obtained a total of $2,865,000 for navigation and general flood control work.

Supplemental grants of $625,000 in cash and $1,475,000 in contract authorizations for Bonneville Power Administration provided $100,000 for operation and maintenance and $2,000,000 for construction.

•

Sale of South Carolina Utility Stocks Approved

The Commonwealth & Southern Corp has been authorized by the Securities and Exchange Commission to sell its 800,000 shares of South Carolina Power Co common stock to the South Carolina Electric & Gas Co. The selling price is to be $10,200,000.

The sale was fought by the South Carolina Public Service Authority (Santee-Cooper) which had offered $11,600,000 for the same stock.

SEC approved the sale to the adjoining privately owned utility because C&S needs the money in a hurry to carry out its construction program elsewhere. There is also some legal doubt to the right of the Authority to acquire an electric utility. Authority officials did not plan to acquire the stock without a favorable decision of the Supreme Court of South Carolina. Nor would the underwriters doing the financing for the Authority agree to purchase and distribute bonds of the Authority until such favorable decision were handed down.

This legal maneuvering would take time. Therefore, SEC felt that the sale to Electric & Gas should be approved to assure C&S of its money without delay.

•

Utilities Must Pay

When streets are improved in Kentucky cities, utilities must pay for any adjustments to their equipment which must be made. This ruling has been made by Assistant Attorney General Carl D. Perkins. The request for a ruling was made by Shelbyville. The Kentucky Utilities Co was one of the utilities involved.

THIS WILL BE AN UNDER-GROUND TRANSFORMER VAULT-WE HOPE.
S.C. ELEC. & GAS CO.
SIDE-WALK ENGINEERS AND CURB-STONE ADVISERS WILL PLEASE STAND ON BOARD-WALK.

SIDEWALK SUPERINTENDENTS were accorded all courtesies when the South Carolina Electric & Gas Co installed an underground transformer vault at the Richland County court house. The sign expressing hope is in reference to the weather conditions which greatly interfered with progress of the work

Power Usage by American Industry High but Can Be Further Expanded

AMERICAN INDUSTRY is using more power than ever before and still has the opportunity to expand this usage. This was the message F. R. Benedict, manager, Industry Engineering, Westinghouse Electric Corp, delivered this week at the Midwest Power Conference at Chicago.

Today, each American worker is backed up by 6.7 hp of electrical power. This figure is high. Further increases must be justified from the economic standpoint. New power use must be justified in terms of cost, quality, and quantity of the manufactured product, he explained.

Future Market Indicated

Then approaching his topic, "Future Electric Power Needs of American Industry," Benedict gave the present usage and indicated the future market in many separated industry operations:

Resistance Welding—There is about 1,000,000 kva of this type of equipment already in service. The metal fabricating industries alone have a potential of over three times this amount. This potential could be reached quickly if fabrication materials became plentiful.

Brazing—Industry has already installed about 50,000 kw of electric brazing furnaces and can readily absorb two or three times this amount.

Infra-Red Heating—A review of the possible potential market for infra-red heating indicates an industry absorption capacity of about 200,000 kw of this type of heating each year for the next ten years.

Induction Heating Market Large

Continuous Annealing — Induction heating, using frequencies from 60 to 200,000 cycles, is being actively investigated and may find wide use in industrial processes within the next few years. The power consumption of such equipment will be high, possibly as much as 5,000 kw per unit, and will be a continuous type of load. The steel industry alone could absorb 1,000,000 kw of this type of heat in a relatively short time.

Electric Arc Furnaces—At present about 3,000,000 kw of such equipment is installed. The figure is growing rapidly. Much of the energy used for this purpose is now generated by industry. In the future the proportion of purchased power will increase. If steel consumption continues to rise, annual increases of 500,000 kw may be expected.

Resistance Furnaces—Industry can absorb 50,000 kw of this type of furnace equipment a year.

RF Heating—The field is broad and some equipment is now in use. The future depends on experimentation.

Factory Lighting — Underlighting is common. A real job must be done to sell industry on increasing light levels at least four times over present levels for higher worker efficiency.

Ore Benefication—The use of low-grade iron ores will require tremendous amounts of power. Conservative estimates are that the industry will require 1,000,000 kw.

Chemical Industry — There are installed today in the aluminum industry about 1,500,000 kw of rectifiers alone. This could very conceivably double within the next ten years. As this type of load is normally on a 24-hour basis, an equal amount of generation capacity would be required. In the magnesium industry, there is an installed capacity of about 400,000 kw. It may double power consumption within ten years.

Mining—Mechanization of coal mining will mean doubling and even tripling of present installed capacity.

Petroleum—Power usage is growing as rapidly as the demand for oil.

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Morton, Ill., Plant Voted

Voters of Morton, Ill., have approved a $700,000 bond issue for construction of a municipal power plant and distribution system. The city is now served by the Illinois Power Co.

We too or Nobody Else

Nobody is going to run any power lines through the Pima-Maricopa reservation in Central Arizona unless the Indians can also electrify their own homes. The Bureau of Reclamation found this out when it sought permission to run a survey through the reservation for a 230-kv line from Prescott to Mesa. Negotiations between the Bureau and the Salt River Valley Water Users' Association brought swift action. The latter has promised to provide service for the Indians.

Utility Management Can Meet Present Problems

Ability of utility management to meet present problems and those which will arise should there be a sharp recession in business, was seen by A. B. McCoard, vice-president of New Orleans Public Service, Inc. But he indicated certain actions will be necessary to uphold the stability and earning power of the industry.

Speaking in Atlanta before the accounting conference of the Southeastern Electric Exchange, Mr McCoard said that if earning power, credit, and ability to finance needed expansion are not impaired then the utility engineers and operating people will have to seek and get improved efficiency from physical facilities.

McCoard declared that the sales people will have to sell services for purposes requiring longer hours use of capacity, the rate people will have to review pricing practices with a view to being sure that costs are received, and financial officers will require all their ingenuity in financing. One major problem of the industry is to get regulatory agencies to cooperate to give quick recognition of utility problems.

The invasion of the private field by public power agencies is an overriding influence which dwarfs all other current problems of the industry in the opinion of Herman W. Bevis, partner of Price, Waterhouse & Co. He traced the rise in public ownership from 3.5% of the industry in 1920 to more than 15% today. He held that the shade of optimism is the questioning of advantages of public over privately financed power facilities.

Bevis cautioned the industry to give careful consideration to the problems of amortization of present high-cost plant on the straight line basis should deflation come.

R. P. Williams, treasurer of Virginia Electric & Power Co, presented a number of possible economies which might be effected in the event of a business recession. He recommended that savings could be effected if estimates are made of meter readings when readings are missed on regular schedule. This practice has worked well with his company. He also recommended bi-monthly readings in rural areas which would reduce expenses an average of $1 a year per customer.

•

Virginia Increases Tax

Virginia has increased the gross receipts tax on public service corporations from 1½ to 2%.

Rain Lessens California's Drought; Reclamation-PG&E Strife Renewed

CALIFORNIA'S DROUGHT has again been lessened by rains, particularly in the northern and central parts where power rationing is now in effect.

With rainfall figures public information, many power users, especially farmers, feeling the economic pinch of the 20% cutback, began to question the necessity of continued curtailments. In answer, Robert P. O'Brien, emergency power director, said that the serious overdraft of water storage was still to be made up.

More controversy between the Bureau of Reclamation and the Pacific Gas & Electric Co appeared to be in the offing. Denying a statement issued last week by the California Utilities Commission, Bureau spokesmen in Sacramento this week (Apr 5) said, "No agreement, verbal or otherwise, has been entered into between the Bureau and PG&E for purchase of additional Shasta Dam energy by the company."

The statement said that the Bureau's agreement that power from the third generator will be delivered "in some manner" to the drought-struck portions of the state had been falsely interpreted.

According to the present Bureau stand, it is up to the Utilities Commission to rule on its demand that the power be delivered to PG&E for exchange to public agencies "without profit." The Bureau admits, however, that if no ruling by the Commission is forthcoming, it may be forced to deliver the power to the company on a day-to-day basis.

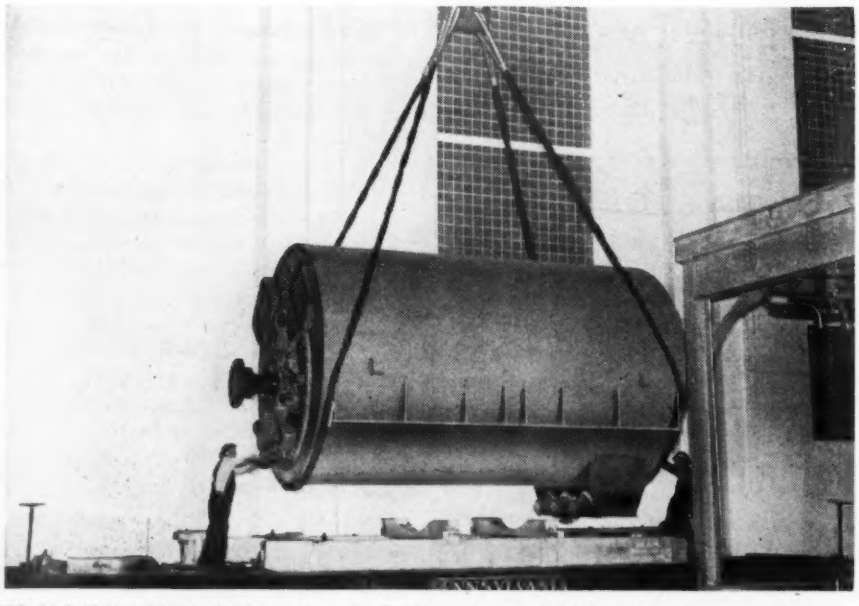
Also announced this week by the Bureau was an increase of generation from two units, bringing total output to 4,000,000 kwhr per week from 2,400,000. This was done because recent rains have brought the reservoir to 3,246,000 acre ft, just 450,000 acre ft short of being full. Present operation is at 170,000 kw, 24 hours a day, 20,000 kw over rated capacity.

Other developments in California's power situation found the Columbia Steel Co preparing to install four 1,000-kw diesel generators. Operation of these is expected to replace the 20% cutback and to return the company's Pittsburg plant to normal production.

Standby facilities of the Pacific Telephone & Telegraph Co have been put into service in the emergency area, thus relieving its usual power source of a load about 2,800 kw.

Two new large plants, recently completed and ready to go into operation, were finally granted enough power by O'Brien to put them into limited initial production. The Dodge Motor Co, San Leandro, was granted 60,000 kwhr per month and the American Radiator & Sanitary Corp., 35,000 kwhr per month for a Richmond plant. These amounts were said to be well under 80% of the requests made by the companies.

Once again a wary eye is being cast at Eastern strikes as possible hindrances to completing generating projects now under construction. If the coal strike continues to hamper steel production, utility men see a chance that equipment for additional generation may be held up. PG&E officials have often blamed post-war strikes as the big reason for the present lack of generating capacity.



60,000-KW GENERATOR arrives at the Redondo Beach Plant of the Southern California Edison Co. This is the first unit of its size shipped by Westinghouse Electric Corp completely assembled with rotor in place. Built according to AIEE-ASME standards recently set up for the industry, the new construction makes possible shipping generators as single units

Westinghouse Advises Against Third Pay Raise

A third round of wage increases can only serve to start up the inflationary spiral once more and for this reason cannot be justified now. This is the advice Westinghouse Electric Corp has extended to its employees in a letter.

"The cost of many consumer items has leveled off or has dropped," said W. O. Lippman, vice-president in charge of plant labor relations. "Westinghouse itself has reduced the price of several products and expects to reduce others. What we have all hoped for—an end of inflation—seems within sight."

"The argument that another wage increase can be paid out of future profits without raising prices was used to justify the two previous rounds of wage raises—and was wrong in both cases, as events proved.

"The management of Westinghouse is fully aware of and is concerned about rising costs of living since the war. But management can't see how a third round of wage raises will improve living standards if, as leaders of organized labor claim, two other very substantial increases failed to do so.

"Prices, which govern living costs," the letter continued, "cannot be reduced as long as wages and salaries are increased too rapidly. More money in your paycheck won't improve your standard of living one bit if, because of higher prices, that money can't buy more of the things you need and want.

"The mad chase by wages to outdistance prices since the end of the war hasn't worked out and will not until industry has had a chance to absorb higher costs of operations through improved production methods—and that takes time."

The letter also pointed out that competition is becoming serious. If Westinghouse is forced to raise prices and thereby loses sales, the final result will be fewer workers and less work for those who are kept on the payroll.

Electric Kitchen Program Given Preview at Sales Meeting of EEI

PREVIEW of a new electric kitchen program was given at the Edison Electric Institute sales meeting in Chicago this week. Complete with plan book and sales helps, the program will be ready for action by utilities and other local elements of the industry early next fall. Spearhead of the program will be a 40-page booklet, entitled the "Kitchenizer's Digest", which will contain complete information on planning, building, and financing the all-electric kitchen.

Last year 167,000 girls enrolled in home making classes in Pennsylvania high schools, said Pauline Saunders, of the State Department of Public Instruction. Dr Saunders gave generous credit to utilities and other business groups who cooperated with school authorities in making these courses modern and attractive to pupils. She spoke particularly of the appliance replacement program by which facilities for instruction of students in her homemaking classes were kept up to date.

Television Usage Growing

There are now 21 television stations on the air. Construction permits have been issued to 70 more, and 156 applications for licenses are pending, said P. J. Chamberlain, General Electric Co. Production of television receivers was about 180,000 in 1947, and predictions for 1948 vary between 500,000 and 750,000. Next year will see about one and a half million sets sold and that figure will be doubled in 1950.

Over 30 million people are within the range of television reception today. About half the population of the country will be able to use television receivers by the end of 1952. Utilities need not fear loss of lighting load from receiver operation, said Chamberlain, because the newer receivers have screen brightness that does not require lights to be turned out for clarity of view.

Responsibility of Salesmen

The power salesman must assume a larger share of responsibility for solution of problems facing the power companies, said Walter C. Beckjord, Cincinnati Gas & Electric Co. He must find ways of increasing energy sales without increasing generating capacity. And if, as is probable, rate increases become necessary, he must be able to persuade the industrial customer to accept them without loss of good will.

Prospects for future industrial power load were related by C. B. Stainback, Westinghouse Electric Corp, in specific terms summing up the uses of electricity by all industry. Stainback predicted an energy consumption in this customer classification of not less than 203 billion kwhr in 1953. This is about a 25% increase over 1947. To meet this demand, utilities will have to continue to install new generating capacity at the same or greater rate than is now planned.

Commercial Sales Growing

Commercial business is profitable business. The long range outlook for energy sales in this field is good, stated P. M. Alden, Philadelphia Electric Co. In evidence of these conclusions, Alden described the commercial sales activities of his company. He presented ten check points—definition of market, purchase of equipment by customers, uses to be promoted, market coverage, selection and training of salesmen, selling tools, compensation of salesmen, sales campaigns, advertising and reporting results.

The United States has the best educated farmers in the world, according to A. B. Kline, president, American Farm Bureau Federation, speaking at a luncheon sponsored by the Farm Section. They know better how to work their land, to husband their livestock, and to use machinery. This result has been the accomplishment of the land grant colleges, aided by American business, with the electric utilities contributing greatly. Report of the remainder of the meeting will be printed in our next issue.

What a Haul?

Equipment weighing 220 tons for the 8,000-hp plant being built on the Snare River in Canada's Northwest Territories, 90 miles northwest of Yellowknife, has arrived on the site. The equipment was hauled 325 miles by tractor train over the ice of Great Slave Lake and then through undeveloped country. Four tractors drew the 25 ten-ton sleighs. Contact with the party was maintained daily by aerial observers who reported progress and helped select the route to be followed. The Canadian Bureau of Mines and Resources is building the plant.

December Electric Energy Sales Advanced 12.4%

Sales of electric energy to ultimate customers in Dec 1947, totaled 19,617,041,000 kwhr the Edison Electric Institute reports. This was a 12.4% increase over the 17,450,280,000 kwhr sold in Dec 1946.

Revenues from ultimate customers amounted to $351,460,200, compared with $311,020,400 in December 1946 an increase of 13.0%.

For the 12 months ended Dec 31, 1948, the average use per customer advanced to 1,438 kwhr from 1,329 kwhr for the preceding year, an increase of 8.2%; the average annual bill to $44.43 from $42.79, an increase of 3.8%; revenue per kwhr dropped to 3.09 cents from 3.22 cents, a decrease of 4.0%.

Classification of Sales, December

Kilowatthour Sales December	Million Kwhr 1947	1946	Percent Change
Residential or domestic	4,329	3,739	+15.8
Rural (Distinct rural rates)	379	302	+25.4
Commercial or industrial			
Small light & power	3,490	3,018	+15.6
Large light & power	9,934	8,832	+12.5
Street & highway lighting	251	236	+ 6.1
Other public authorities	530	600	—11.7
Railways & railroads			
Street & interurban	409	428	— 4.6
Electrified steam railroads	239	238	+ 0.2
Interdepartmental	56	55	+ 0.8
Total to ultimate customers	19,617	17,450	+12.4

Pacific Power & Light Co Will Intertie with BPA

Construction of a $1,400,000 power transmission line into Central Oregon by the Pacific Power & Light Co received the green light with conclusion of an agreement with the Bonneville Power Administration.

The line will run from the company's Tygh Valley hydroelectric plant below The Dalles, Ore., 59 miles south through Maupin and Madras and connect with the company's Cove plant on Crooked River. The link will connect the company's Deschutes system, serving the Bend-Redmond-Prineville-Madras area, with main lines serving the Columbia Valley area.

The agreement with Bonneville coordinates the project with proposed government construction. The 42-mile Maupin-Madras section will be built to the government's 230-kv specifications. The government is retaining an option to purchase the line at cost, as it is needed as a link in a projected Bonneville circuit tying Central Oregon with the Bonneville system.

Another Petitions FPC for Kings R Power Site

A wealthy Los Angeles engineer has entered the already muddled fight over who is going to develop the hydroelectric potential of California's Kings River.

Francis N. Dloughy, who previously has proposed a number of other projects on the same stream and its tributaries, asked the Federal Power Commission recently for a preliminary permit for a 410,000-hp plant in Fresno County. The project would include a dam near the junction of the middle and south forks of Kings River, and a 15-mile conduit to a powerhouse near the mouth of the north fork. Dloughy reported the energy developed would be for "general distribution" in California.

The Dloughy plan apparently would conflict with several projects already proposed for Kings River by the Army Engineers, the Bureau of Reclamation, the Fresno Irrigation District, and the Pacific Gas & Electric Co.

The Engineers already have started construction of Pine Flat Dam, energy from which will be marketed by the Reclamation Bureau. The latter agency also has plans for upstream power developments. The Fresno District has applied to FPC for a permit to erect a hydro project above Pine Flat, and PG&E is seeking licenses for a series of dams and power plants on the north fork of the stream.

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Duke Power Co Plans 2 Plants in S. Carolina

Duke Power Co plans to construct two steam generating plants in upper South Carolina. The one is to be on the Broad River in Cherokee County, the other on the Saluda River along the Anderson-Greenville County borderline. Each plant is to cost $10,000,000 with an initial installation of a 100,000-kw unit.

Preliminary plans were disclosed when bills were introduced in the South Carolina General Assembly to authorize the company to construct diversion dams on the two rivers.

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Utilities Bill Tax Voted

New York cities of 25,000 or more population have been authorized to tax consumers of utility services 3% of their bills. Gov Thomas E. Dewey signed the measure which will become effective May 1.

SEC RULINGS

KANSAS GAS & ELECTRIC Co has received commission approval of its sale of $5,000,000 of first mortgage bonds due 1978. (Release No. 8033).

COLUMBIA GAS & ELECTRIC CORP has been permitted to offer at competitive bidding $45,000,000 of debentures, due 1973. Proceeds of the issue will be used to finance a 1948 construction program of subsidiary companies expected to cost $44,006,613. (Release No. 8037).

STATEN ISLAND EDISON CORP, a subsidiary of the General Public Utilities Corp, has received permission to borrow $1,750,000 from three commercial banks on 2% notes maturing in six months. Staten Island Edison proposes to use the loan to pay off $1,500,000 of notes and to reimburse its treasury for capital expenditures. (Release No. 8048).

NEW ENGLAND POWER Co has received authorization to issue to the First National Bank of Boston or Worcester County Trust Co, from time to time, but in any case not later than June 30, 1948, unsecured promissory notes due not more than one year from date of issuance and bearing interest at the rate of 2%. The aggregate of such notes is not to exceed $2,850,000. Proceeds will be used to finance temporarily the company's construction program estimated at $1,410,000 for the period ending June 30, 1948, and to pay off $1,550,000 of outstanding notes, proceeds of which were applied to new construction. (Release No. 8078).

OKLAHOMA GAS & ELECTRIC Co, a subsidiary of the Standard Gas & Electric Co, has received permission to sell at competitive bidding 65,000 shares of cumulative preferred stock, $100 par value. Oklahoma Gas proposes to use the proceeds to finance construction. (Release No. 8058).

CENTRAL MAINE POWER Co has been authorized to increase its short-term borrowings from the First National Bank of Boston from $4,400,000 to $7,500,000, the new borrowings to be represented by promissory notes carrying interest at 1¾%. Funds are to be used for construction purposes pending permanent financing, anticipated in the approximate amount of $10,000,000 not later than Sept, 1948. (Release No. 8081).

TEXAS POWER & LIGHT Co has been authorized to issue and sell at competitive bidding $2,000,000 of first mortgage bonds, series due 1978, and $7,000,000 of sinking fund debentures due 1973. Proceeds are to be used to finance its 1948-1949 construction program. (Release No. 8087).

MEETINGS

PREVIOUSLY LISTED

Indiana Electric Association—Young Men's Utility Conference, Ipalco Hall, Indianapolis Power & Light Co, Indianapolis, April 13-14.

Northwest Electric Light & Power Association—Engineering and Operation Section, Davenport Hotel, Spokane, April 14-16; Annual Business Meeting, Empress Hotel, Victoria, B. C., May 10; Business Development Section, Empress Hotel, Victoria, B. C., May 10-12; Accounting and Business Practice Section, Davenport Hotel, Spokane, May 17-18; Personnel Section and Safety Conference, Medford Hotel, Medford, Ore., June 9-11.

Electrochemical Society—Spring Congress, Deshler-Wallick Hotel, Columbus, Ohio, April 14-17.

Edison Electric Institute—Purchasing and Stores Committee, Hotel Cleveland, Cleveland, April 19-21; Engineering Committees, Edgewater Beach Hotel, Chicago, May 3-5; Annual Convention, Hotel Traymore, Atlantic City, June 1-3.

Southeastern School Lighting Institute—Suwannee Hotel, St. Petersburg, Fla., April 19-21; Exhibit, Mirror Lake Junior High School, St. Petersburg, Fla., April 19-May 15.

Rocky Mountain Electrical League—Spring Conference, La Fonda Hotel, Santa Fe, N. M., April 22-23.

American Institute of Electrical Engineers—North Eastern District Meeting, Taft Hotel, New Haven, Conn., April 28-30; Summer General Meeting, Palace of Fine Arts, Mexico City, Mex., June 21-25.

Missouri Association of Public Utilities—Annual Convention, Hotel Jefferson, St. Louis, April 28-30.

National Electrical Wholesalers Association—Annual Convention, Hotel Statler, Buffalo, May 3-7.

Missouri Valley Electric Association—Rural Round Table, President Hotel, Kansas City, May 5; Sales and Rural Conference, President Hotel, Kansas City, May 6-7.

Southeastern Electric Exchange—Spring Conference, Engineering and Operating Section, Tampa Terrace Hotel, Tampa, Fla., May 6-7.

Pennsylvania Electric Association—Communications Committee, Hotel Traylor, Allentown, May 6-7.

Pennsylvania Electric Association—Systems Operation Committee, Castleton Hotel, New Castle, May 13-14; Prime Movers Committee, Hotel Casey, Scranton, June 10-11.

Engineers Club of Philadelphia — Engineering Progress Show, co-sponsored by junior members and the Franklin Institute at the Institute, May 11-16.

Electrical Manufacturer's Representatives Association of Michigan—Industrial Electrical Exhibit, Convention Hall, 4484 Cass Ave., Detroit, May 12-14.

New Jersey Utilities Association—Spring Meeting, Seaview Country Club, Seaview, N. J., May 14.

American Public Power Association—Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., May 17-19.

Public Utilities Advertising Association—Annual Meeting, Hotel Cleveland, Cleveland, Ohio, May 27-28.

American Society of Refrigerating Engineers—Spring Meeting, New Ocean House, Swampscott, Mass., May 31-June 2.

Arkansas Utilities Association—Annual Convention, Arlington Hotel, Hot Springs, Ark., June 14-15.

American Society for Testing Materials—Annual Meeting, Book-Cadillac Hotel, Detroit, June 21-25.

Canadian Electrical Association—Annual Convention, Manoir Richelieu, Murray Bay, Province of Quebec, June 16-19.

VEPCO Gives 10% Raise in New IBEW Contract

One of the utility industry's knottiest labor situations was ironed out this week (Apr 5) when Virginia Electric & Power Co came to terms with the International Brotherhood of Electrical Workers.

VEPCO and the union had been negotiating for several weeks over a new labor contract covering the company's rank-and-file employees. Their former contract expired Mar 31. Salient features of the new one-year agreement included the following provisions:

1. A 10% increase in wages for all employees.
2. A shift differential of 5 cents per hour for second and third (non-daylight) employees.
3. Modifications of former union security and union liability clauses.

Significant because of its absence from the contract was mention of VEPCO's foremen. IBEW attempted during the contract negotiations to renew the temporary, one-year contract signed by its foremen's union and the company last year. VEPCO has refused to consider renewal of the latter document since passage of the Taft-Hartley Act.

The company also rejected IBEW demands for additional holidays in the new contract. This was another demand which apparently had stalled the negotiations.

In place of a union security clause, the agreement commits the company to a voluntary check-off system. Employees who agree to submit to the check-off will be subject to it for one year thereafter.

Modification of union liability was contained in a provision whereunder the company will take no legal action against the union for work stoppages provided the union does instigate, support, or otherwise encourage a strike. This proviso also binds local unions and individual members not to participate in strikes.

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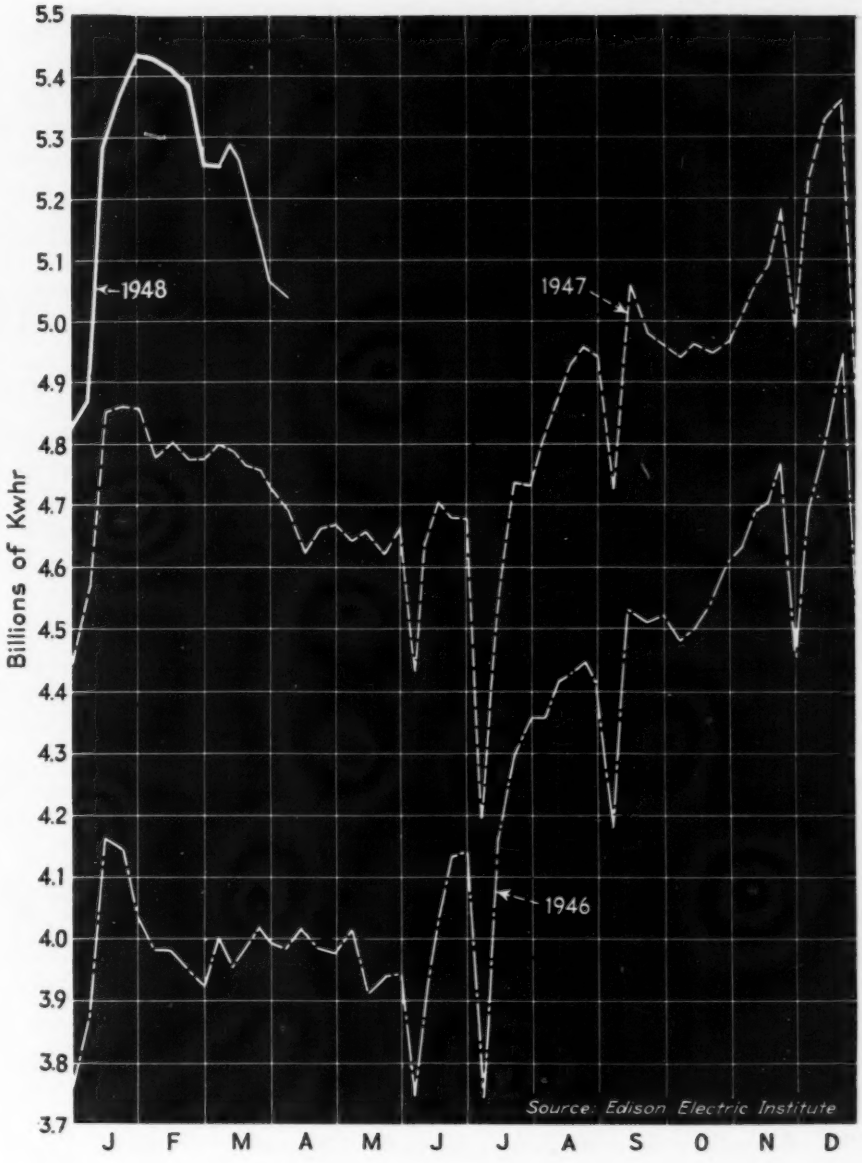
Cities and Co-ops Gain

Alabama Power Co has been ordered by the Public Service Commission to reduce the price of electricity sold to ten municipal systems and to eleven cooperatives. Ten cities affected will save $29,471 a year on their purchases. Refunds will be approximately the same as the order is retroactive for almost a year. The co-ops will save $22,708 annually and will get refunds of $21,000.



If Anybody Ever Sends Arput Any Dough—Well!

Output editor ARPUT found two clippings. One headline said: "Marshall Returns $250 Sent to Aid Europe"; the other: "Attlee Gets 43 Cents Saved for U. S. Comics." Seems some Californian wanted to help Uncle Sam foot the ERP tab. And a Cardiff nipper tried to ease Albion's dollar shortage. Only Attlee KEPT the dough.

This made ARPUT wild. If Attlee needs two bob, tuppence, who's Marshall to snub two and a half yards, U. S.? Like the output, my faith keeps going down."

Other News

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Weekly Output, Millions Kwhr

1948		1947		1946	
Apr. 3	5,037	Apr. 5	4,693	Apr. 6	3,988
Mar. 27	5,065	Mar. 29	4,729	Mar. 30	3,992
Mar. 20	5,145	Mar. 22	4,759	Mar. 23	4,017
Mar. 13	5,285	Mar. 15	4,764	Mar. 16	3,988
Mar. 6	5,293	Mar. 8	4,787	Mar. 9	3,953
Feb. 28	5,252	Mar. 1	4,797	Mar. 2	4,000
Feb. 21	5,254	Feb. 22	4,778	Feb. 23	3,923
Feb. 14	5,385	Feb. 15	4,778	Feb. 16	3,949

Percent Change from Previous Year

	Apr. 3	Mar. 27	Mar. 20
New England	+ 7.6	+ 7.1	+11.2
Mid-Atlantic	+ 4.5	+ 4.1	+ 6.1
Central Industrial	+ 7.2	+ 5.9	+ 7.3
West Central	+ 5.7	+ 3.2	+ 6.5
Southern States	+10.3	+10.4	+ 9.8
Rocky Mountain	+10.6	+11.4	+14.1
Pacific Coast	+ 6.2	+ 8.5	+ 7.8
Total United States.	+ 7.3	+ 7.1	+ 8.1

WASHINGTON COMMENT

RICHARD N. LARKIN

1947 WAS A YEAR when prices went through the roof and most legislators tried to pass laws which would protect the public from labor strife in the utility industries. As yet, nobody's done anything about prices and the same may prove true about utility strikes.

Wisconsin was one of many states to pass anti-utility-strike laws in 1947. It depended completely upon compulsory arbitration, outlawing strikes before, during and after the mandatory settlement set up by law. Quite recently, Judge Alvin C. Reis gave the new law a somewhat more emphatic throwing around than he recently dealt the startling Two Rivers rate order. It will be recalled that he was far from gentle with the Two Rivers "no-rate-base-no-rate-of-return" doctrine.

"Law," wrote Judge Reis, "perhaps may demand a cooling-off period and forbid a strike until the dispute has been arbitrated; but constitutionally, law cannot prohibit a strike even after arbitration and forever—and even though the purpose is legitimate and lawful—whether that strike be by utility employes or any other employes."

In an era so accustomed to the brazen violation of human rights, it is hard not to cheer Judge Reis' emotional decision. Yet, when the emotion dies, it is hard not to ask: "What now?" Granted that it's no tiny feat to strike a hard blow for freedom. But it seems even harder to legislate effectively and still leave freedom unimpaired.

To be sure, overturn of the Wisconsin law leaves all the others on the books. But they are unchallenged. And most of them rest on compulsory arbitration. Virginia's doesn't; it approaches intimidation. Whatever the device, any law dealing with utility strikes, sometime or other, somehow or other, has to prevent men from striking who are determined to strike. Like perpetual motion, it's a neat trick if you can do it.

Regardless of the treatment Judge Reis' decision gets in the appellate courts, his opinion raises a timely point! What is vital to modern life? Those who think this isn't a toughie should gaze about. John Public feels a power, gas or water strike faster than he does a stoppage in steel, coal, or oil. But the difference is pretty relative. In 30 or 60 days, the production of steel, oil or coal becomes "must" stuff, from the bar to the bathroom. Right now a joint Congressional committee is racking its brains for a foolproof, no-strike formula for the atom business, which also is a "must." And the implications are plain that their formula will be just as binding on any industry which contributes vitally to bomb production as it will be on the bomb business.

Maybe the joint atom committee will write the no-strike formula which will settle the threat of strikes in the public service field. If so, it will be doing something Congress couldn't do last session in the Taft-Hartley Act. That law merely gives you 80 days in which to slug the parties into line, as per the Railway Mediation Act principle. This was a good principle, too—until late May, 1946, when the railroad men struck anyway.

TECHNICAL TRENDS

ARCHER E. KNOWLTON

Pressure relief diaphragms are up for improvement. Objectives are positive relief, durability, smallness, minimized maintenance, fatigue-resistance, non-corrosiveness, easy calibration, ability to withstand normal pressure testing, and ruggedness with simplicity.

Two-wire meters will grow in surplus as load demands necessitate their replacement by 3-wire meters. Electrically lagging countries ought to absorb some of them.

Rural lines involve rangy distances and expensive travel time. That is one good reason for building them as ruggedly as economics will warrant. Cheaply built lines can prove expensive.

Relay testing on too frequent a schedule multiplies chances for operating error during test. As has become fairly common in the case of breakers, why not, say some, let the periodicity depend on the frequency of discovery of defects or maladjustments?

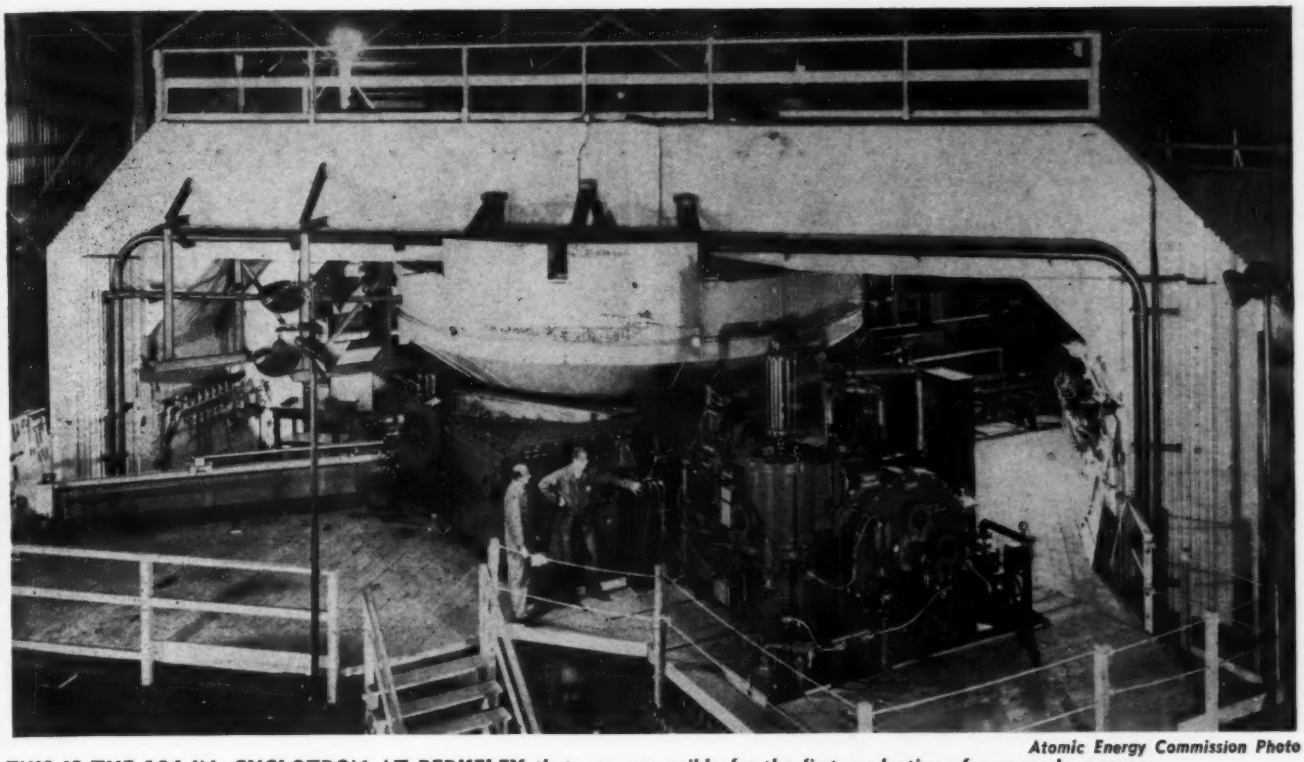
Cinder fills are poor heat conductors. Cable duct temperatures rise disadvantageously. Excavations around power houses seem always to be refilled with cinders. The danger should be explained to the yard foreman.

Pipe-type cable installations are increasing. Less street space, longer lengths, fewer manholes, comparatively small increase in cost, better temperature equalization are some of the advantages cited.

Shaft-exciters have to share the spot-light with motor-driven units. One disadvantage, outside the customary realm of argument, is the greater width of overhead crane required.

Galvanized structures such as for switching stations will last longer if they can be placed on the windward side of the plant stacks.

Anti-freeze solutions have proven helpful in preventing freezing of moist-air in pipe runs of common air-supply system. The air picks up the anti-freeze at the tempering tank.



Atomic Energy Commission Photo

THIS IS THE 184-IN. CYCLOTRON AT BERKELEY that was responsible for the first production of man-made mesons

What Happened In Atomic Energy In '47?

IS AMERICA'S atomic energy program stagnating?

You don't have to talk to very many people in industry or in government today to hear that it is.

You can hear that the Atomic Energy Commission has enmeshed itself in red tape and indecisiveness.

You can also hear that it is arbitrary and dictatorial.

You can hear both that AEC has sold out to the military and that civilian control of the atom is jeopardizing national security.

One man will tell you that potential civilian applications of nuclear fission are being sidetracked; another will insist that AEC is plotting a nationwide TVA based on atomic energy.

At the same time, there's an increasing tendency to re-examine the basic law, (McMahon Act), which governs atomic energy work. Here too, there's a whole series of cross-purposed ideas.

Many government people would like to see a lot of the law's technical points clarified in the light of today's understanding of the problems. And they'd like to do something about the multiplicity of committees now required to breath down the neck of Lilienthal and his colleagues. This group is not pushing its ideas. It is deathly afraid of the sweeping and unwelcome changes that might be made if the law were ever thrown open for discussion.

What's particularly feared is the recurring talk in Congress of turning atomic energy control back to the armed forces. You'll hear talk of this from Taft people in the Senate, for instance, or around the House Committee on Un-American Activities.

Outside of Congress, there are stirrings of an attack on an even more fundamental tenet of the McMahon Act—socialization of atomic energy. A few technical people, some businessmen, are beginning to argue that atomic progress would be faster if the whole field were thrown open immediately to industrial development on a profit basis.

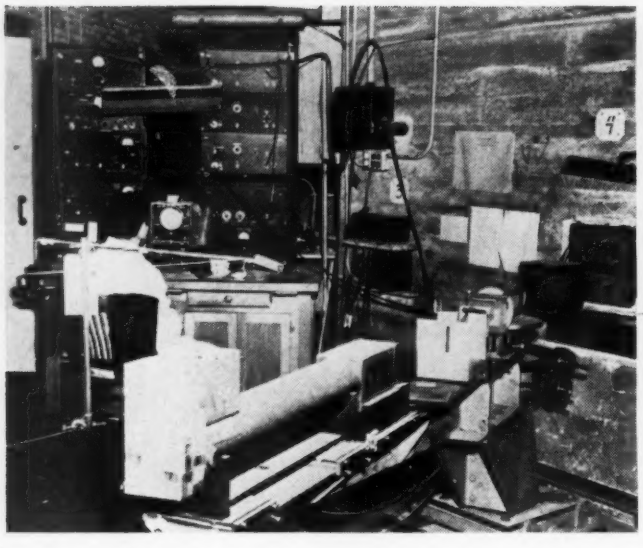
In this jungle of debate, accusations, and complaints, what are the facts?

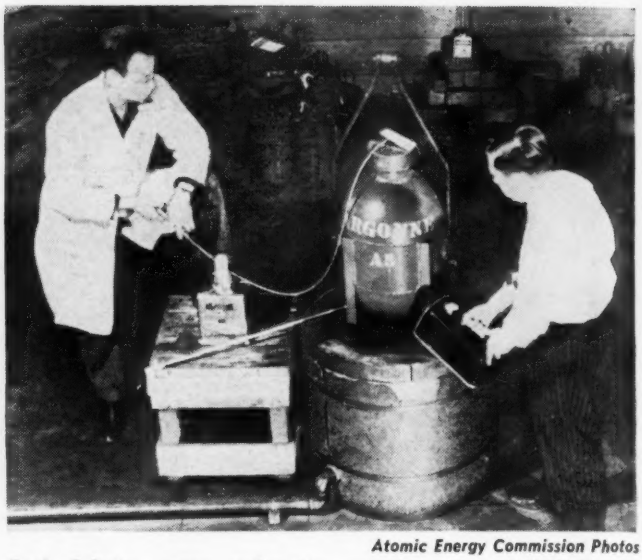
Is America moving ahead on atomic energy? How fast? And in what direction?

What are the real issues in dispute as to the Atomic Energy Act?

For the businessman trying to gauge the eventual impact of atomic energy on his industry, for the citizen trying to form an intelligent opinion on this national issue—the facts are extraordinarily hard to come by. The information that anyone naturally would seek first—on production rates, costs, resources—is

ELECTRICAL WORLD'S second report on the non-technical aspects of the atomic energy program. The first was published in *Electrical World* for March 15, 1947. Both were written by Robert Colborn, of McGraw-Hill's Washington Bureau, after extensive investigations in Washington and in the field.





Atomic Energy Commission Photos

CRYSTAL SPECTROMETER (left) measures ability of a material to capture neutrons. Reflected beam of neutrons is detected by proportional counter filled with boron trifluoride gas. At right, Fred Cokeing moves radioactive material from "thimble" into "torpedo" of Argonne National Lab's heavy water pile. Dr. W. H. McCorkel (with Zeus) measures escaping radioactivity

all stamped TOP SECRET. Even the nature of the problems ahead, the technical reasons for policy decisions, the terms of contracts, are obscured, if not hidden, by secrecy requirements.

You can ask the experts, the men who know the classified information. But you have to be careful not to ask two experts. If you do, they'll disagree, and neither is allowed to tell you the basis for his conclusions.

In this situation, McGraw-Hill's Washington Bureau has re-examined the whole atomic energy program. The study starts from a background of close coverage ever since Hiroshima. It didn't ask for—and didn't get—any secret information. But it did cover government officials, both in and out of AEC. It visited every major atom plant and laboratory. It conferred with industrial leaders—both those involved in the atom program and those who have chosen not to be involved. Briefly, these are the conclusions it reached.

After A Poor Start, AEC Recovered Well

The short run:—The atom management's Number One job, of course, is to keep the war-built plants running, to maintain the bomb production achieved by the Manhattan District.

On this, there has been no faltering, no interruption of production.

At Oak Ridge, efficiency in the separation of fissionable uranium has been greatly stepped up. At Hanford, production of plutonium has been maintained in the face of great technical obstacles. At Los Alamos, manufacture of the electronic and mechanical apparatus of the bomb has been headed from a laboratory toward a factory operation.

Next steps:—Equally important for the long haul, with operation of existing plants, is the job of picking up where the Manhattan District left off—of advancing the atomic art.

In military terms, this means: does the U. S. wait for the rest of the world to catch up with its wartime achievements? Or do we push ahead with the development of better weapons—and more of them—so as to keep its present lead? In technical terms: are Americans learning more about what goes on in the atomic nucleus, about how to control atomic reactions? Are the theoretical possibilities being reduced to engineering practice?

At this level, no such unqualified endorsement as the short-term job has earned can yet be given to the government's atom program.

Six Months Report

Six months or so ago, it would have been necessary to report that the forward-thrusting phase of atom work was near stagnation. For example:

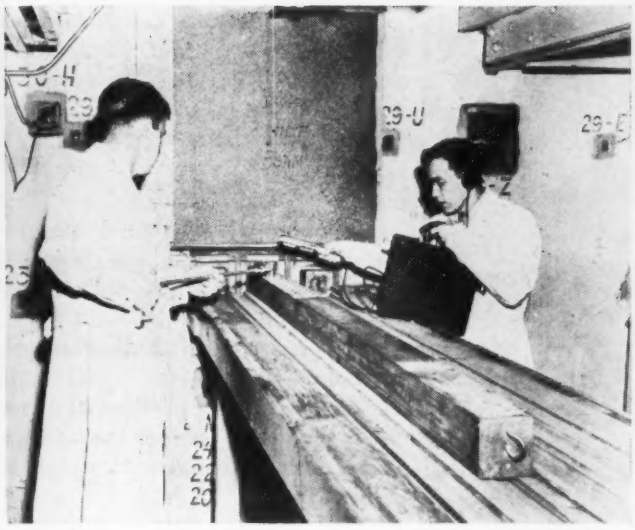
1. Preparations for a new and bigger plutonium plant—AEC's highest-priority—were enmeshed in the engineering and personnel difficulties of a tremendous job.

2. Weapons research was at loose ends. It was operating in a vacuum without guidance from either the military or the Atomic Energy Commission.

3. Construction of new types of atomic reactors, the key devices for utilization of nuclear fission, was being held up by vacillation and indecision in the Atomic Energy Commission.

4. Throughout the atom project, morale was low. Many technical people were leaving; many of those who remained were discouraged and uncertain. They were conscious of a lack of direction and impetus. Unable to get Washington approval on new programs, they often were reduced to marking time.

Many scientists, government and industry people who had fought hardest for a civilian commission were beginning to feel that their efforts had been wasted. In some cases, they were only restrained from attacking AEC by the fear that something worse would replace it.



Atomic Energy Commission Photos

RADIOACTIVE MATERIALS removed from a chain reactor at the Argonne National Laboratory. (Left) Scientists Elmer Rylander and Earl Cobb measure the amount of radioactivity emitted by the material. Doctors David and Jane Hall, (right) developers of the "fact reactor", pictured at the instrument panel. This is the "vest-pocket power plant" at Los Alamos

That was late last summer. And that was the bottom. At just about that time. the year-old AEC began to get a grip on its huge job. Things began to improve. Today, the situation is still spotty, good here, bad there. But everywhere, it is visibly on the mend.

Able Administrators

An early and fruitful step was the appointment of an able group of regional administrators who could give local leadership to the atom projects. These men were granted a large measure of autonomy. At Hanford and Oak Ridge, for instance, the local men can OK expenditures up to $5 million without reference to Washington; this is almost unprecedented in government. And this frees the operating contractors at the sites from a tremendous amount of waiting on Washington.

Additional contractors were brought in to beef up the design force on the new plutonium plant at Hanford. This program is now rolling. Design is well along; preliminary construction work is already under way and will reach a high level later this year. The whole Hanford project radiates verve and enthusiam.

Weaponeering at Los Alamos still has a long way to go to match Hanford's drive. But at least a research program has now been agreed on among AEC, the military, and the scientific laboratory. Now the laboratory is squaring away.

Similarly, in the reactor program, the designers are ready to go now on three or four new piles that have been awaiting the nod from Washington for a year or more. There was a radical reorganization of the reactor program. Work which had been divided between the Clinton Laboratory at Oak Ridge—a trouble spot for several years—and the Argonne National Laboratory at Chicago is now done at the Argonne.

The program which AEC has now taken off dead center and is beginning to push along is, above all things, an armament program. The way the world goes now, the commissioners figure that production of bombs takes precedence over everything else.

A Generation Away

The publicity still goes to the civilian applications of atomic energy—actual or potential. In almost weekly speeches, the commissioners have been emphasizing that there's more to the atom than explosives. But the fact is that something around 80% of the AEC's money and effort is directly aimed at maintaining and increasing the production of bombs.

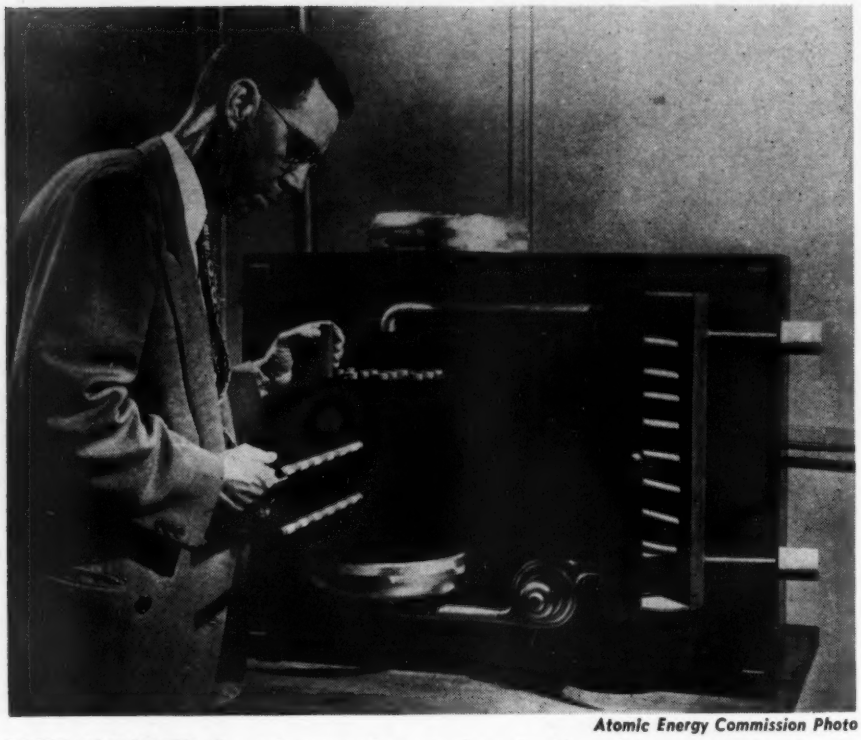
This concentration on weaponeering inevitably has a retarding effect on civilian applications. The most immediate application—production and distribution of radioisotopes—doesn't compete seriously for material or engineering talent. That's why it has been able to forge ahead rapidly.

But application of the atom's power to non-destructive uses definitely does compete for both material and talent. The result: Work in this field has had to be laid out on a rather slow schedule. This puts economically-significant power utilization a generation away. In order to economize on engineering talent, particularly, the power work is largely being put into academic hands. AEC's industrial contractors are being discouraged from putting too much of their effort into power.

Step-By-Step Process

Power problems, in general, are being tackled in a conservative, step-by-step way. The wartime method of bulling ahead, of taking the long jump, of trying to apply right away the extreme theoretical possibility—this has been dropped. The approach now is to precede each short step forward by exhaustive analysis and investigation, to take no chances on building something that won't work.

Not only is AEC's program a military one—it is a rather narrowly military one. Even such projects as atomic propulsion of warships, bombing planes, and missiles are subordinated to production of explosives. This policy is disturbing even to some people in the armed forces. The Air Force has been indignant over the low priority granted to the NEPA (Nuclear Energy for Propulsion of Aircraft) project. And a year ago, Admiral Parsons, head of the Navy's atomic weapons unit, was arguing



Atomic Energy Commission Photo

BASIC ELEMENTS of atomic power plant are shown in this model, constructed under the supervision of Dr Kenneth H. Kingdon. The model is not full scale. At left is the atomic "pile" where matter is transformed into energy by the splitting of uranium or another fissionable element. The striped rods projecting horizontally represent the control rods which would prevent the process from running away. A heat exchanging fluid would be pumped through the pile, thence to the heat exchanger on the right, where water would be turned to steam. This would then be used to drive turbines in the customary way

that industrial applications of atomic power (supplying decentralized plants, for instance) might have as much military significance as bombs themselves.

On the industry side, much of AEC's difficulty in attracting contractors, in laying a broad base of industrial participation in atom work, is traceable to the postponement of economically interesting applications.

Why did it take the Atomic Energy Commission a year to get a grip on its job? Why has the civilian commission turned out to be so different from the expectations felt when Lilienthal was named to head the new body?

At that time, it was feared or hoped, on the basis of the chairman's record, that he would head a hell-for-leather organization. His preoccupation would be the most rapid exploitation of the new nuclear technology and its planned merger into the national or world economy. Perhaps, the talk ran, he'd be inclined to use atomic energy, like hydro-electric power in the Tennessee Valley, as a broad economic and social tool.

One major reason, unquestionably, has been the unprecedentedly vituperative political attack on the Lilienthal organization. You have to go back to the WPA to find an organization which has had so many people ready to pounce on it. Moreover, the attacks have been of a peculiarly intimidating type. By-passing the normal questions of policy and competence, they have concentrated their fire on the personal loyalty and patriotism of AEC personnel, from the chairman on down.

These constant attacks have hit home. They have produced in the commission a timidity, an extreme sensitivity to criticism. Some AEC policy—on technical secrecy, for instance, and perhaps, in part, the concentration on bombs—appears to be dictated by a need to prove that a civilian commission can be just as military as the military.

Lilienthal is not regarded as expendable—either by himself or by his associates. Throughout the organization there is a sincere feeling that any alternative leadership would be so obscuranticist, so insensitive to the complexities of the problems, as seriously to jeopardize national security. Nothing must be done, it is argued, which might threaten the re-appointment of the commission in August, or its confirmation next year.

Buck Fever

Another psychological factor at work is a sort of buck fever. The commission is tremendously impressed, almost to the point of paralysis sometimes, with the sheer magnitude and importance of its job. "When we have a question to decide," complains one official "we act as if our decision had to stand for fifty years."

AEC makes no snap judgments. In consequence, it makes few quick ones. Hence, too, AEC's mania for consultation, which has resulted in an almost comical spawning of advisory committees.

Lilienthal's cautious, conservative approach, of course, is not necessarily the wrong one. It makes for a slow start. But it may end up with a sounder program in the long run—both in the technical sense and in terms of public acceptance. To date, certainly, AEC can be accused of few serious blunders.

One effect of the AEC's slow start has been to contribute to a feeling among some industry people that the McMahon Act took the wrong track when it put atomic development primarily into government hands. This is distinctly a minority feeling at present—a rather surprisingly small minority considering the radical nature of the law.

Public Control

Atomic energy, under the McMahon Act, has been described as an island of socialism in a sea of private enterprise. It's not quite that unique; synthetic rubber has similar government sponsorship, and synthetic oil appears to be moving in the same direction. But never has so potentially important a technology been subjected so completely to public control.

Production of fissionable material (bomb stuff) is now overwhelmingly the biggest part of the atom industry. This, and the production of atomic weapons, has been made a government monopoly. It is illegal for anyone to produce or possess either uranium 235 or plutonium, except as a government contractor or except in

negligible quantities incident to other activity.

All other atom work except research is subject to government control through a system of federal licensing.

At any time AEC concludes that commercially useful results can be obtained from atomic processes it must, before it may grant a license to any firm, report to Congress and give the legislators ninety days to study the subject.

Atomic patent policy corresponds with this set-up. A patent's promise of a private monopoly offers no incentive to research in an area which is already a government monopoly. Thus patents are wiped out so far as production of fissionables is concerned. Instead, provision is made for a system of government rewards for discoveries; the amounts are to be set by AEC subject to court review.

Patents are permitted in the other atomic fields, the fields subject to regulation rather than monopoly. But these patents are limited by a requirement that they must be licensed to others at a reasonable royalty, if AEC so directs.

Theoretically, private atom work is possible under this law. A firm could finance and carry on research. If it made a discovery in the field of production it could claim a special government award. Or on the basis of an application discovery requiring the use of fissionable materials it could seek a license and go into business. But the prospect is hardly very attractive. There's no promise of exclusive patent protection in a discovery. And there's complete uncertainty as to future federal policy. Essentially, the atom today is the government's baby.

The Socialized Atom

The atom was socialized in 1946 with a minimum of debate or discussion. The arguments centered around a subordinate issue: how much influence should the military exert over government atom controls? But the major motives for socialization appear to have been these:

The present law is explicitly temporary. It was intended only to cover the interim period before profitable application of atomic work is possible. So the role of private industry was left for later determination.

Two years ago, international control of atomic energy looked imminent. It was feared that to permit private exploitation of the atom might create vested interests which would stand in the way of international arrangements.

There was some fear that private researchers, building on the government's $2-billion investment, might patent some basic discovery that could lead to monopolization of the whole field.

National security considerations, it was felt, required the government to allocate closely, material supplies and manpower in this field. This was to insure that military needs were not slighted. And the simplest way to do that seemed to be to throw the whole job entirely to the government.

Today, some businessmen are beginning to argue that most of these points are now obsolete. Eliminate government monopoly and restore normal patent incentives throughout the atomic field; then, they insist, private money would flow in and atomic development would go forward in a manner more businesslike, faster, and cheaper.

This approach is found particularly in the more patent-conscious sectors of business, such as the oil and chemical industries. Here, the patent clauses of the McMahon Act are seen as an insidious attack on the patent system generally.

Most businessmen disagree. This field, at this stage, they feel, is inevitably governmental. They can't see any possibility now that business would want to invest much in the atom. Almost any sort of atomic research or development work takes large money, running into the millions; the pay-off is distant and uncertain. Moreover, under any law, the government's huge bomb program is clearly going to dominate the field for the visible future—and this in itself makes the atom a relatively unattractive investment for private money.

So the McMahon Act, these businessmen say, is reasonably satisfactory for the present. It gets the work done, one way or another. And when the time comes for commercialization, everyone will start even at least patent-wise.

No Great Hurry For Atomic-Electric Power

Key fact about development of useful power from atomic energy is that no one in the United States needs atomic power very badly.

What atomic energy could provide in the near future, most technicians guess, is a practically unlimited source of electric power. It would be a little cheaper, perhaps, than power from coal. It would be more expensive, almost certainly, than hydroelectric power. Its most peculiar economic characteristic would be that, so far as fuel is concerned, it would cost about the same anywhere—on top of the Andes or in New York City; the manager could bring the day's fuel to work in his briefcase.

To a nation which possesses a 2,000-year reserve of coal, such a prospect is not terribly exciting. Conceivably, it might change the cost factors in plant location of some U. S. electro-process industries — moving them closer to raw materials or markets. However, the University of Chicago's Cowles Commission, which has been making a study of transportation-free, 4-mill power, thinks not.

It is considerations like these, rather than technical factors, which set the time scale for useful atomic energy. You can find competent technical people who are confident that on a "work-it-out-as-you-go-along" engineering basis, they could deliver you, if you wanted it, a commercial-size, reasonably-economical power plant along about 1952.

But the AEC doesn't want it much. The commission is scheduling its power work to produce an economic plant sometime around 1960. Throughout the sixties it looks for steady installation of additional plants. By 1970, atomic energy might be supplying 20-25% of the country's power needs.

Atomic Energy Commission Photo

CLOUD CHAMBER PHOTOGRAPH shows disintegration of atomic nuclei caused by 100 million electron volt neutrons. The "stars" shown represent the flying apart of particles of an atom of oxygen struck by a neutron. The very heavy tracks are formed by alpha particles

The rest of the world, however, is not likely to be so casual about power possibilities. The Cowles Commission thinks that on the central European plain—the Balkans and western Russia—there's a combination of developed industry, fuel scarcity, and expensive transportation that would make atomic power attractive.

The coal-starved British, who have budgeted about $120 million for atom work, are believed to be stressing power development.

So the first substantial power plants may well appear outside the United States.

The one exception to U. S. indifference about power plants may turn out, curiously enough, to be the Air Forces. Their NEPA project is built on the "long-jump" psychology that went from a wiggle on an oscilloscope in 1939 to Hiroshima in 1945. Fairchild Engine & Airplane Co is principal contractor. Its object: to try to build right away, an atomic power plant for an airplane.

When you remember that today's heavy bombers carry as much as 40 tons of gasoline (which a NEPA engine wouldn't need) this seems less fantastic than at first glance. Even so, "respectable" atom people are pretty scornful of NEPA. They're sure the only sound route is through stationary power plants, to ship propulsion, and eventually to aircraft. The friendliest of them feel toward NEPA much as a man who is holding down a steady job with a future might feel toward his flyer in the grain market.

NEPA's Problems

So far, NEPA has been hardly more than a drafting board operation. It has spent little more than $3 million, has had a total allocation of only $10 million, has a staff of about 300 people at Oak Ridge. Its biggest handicap has been a low priority on personnel. This has forced it to rely heavily on enthusiastic youngsters learning their nuclear physics on company time.

Now NEPA has reached the turning of the ways. Its people feel they are ready to start building something. The question is whether it'll get money and a recognized place in the atom program.

Last December Forrestal's top-level Joint Research and Development Board recommended that it should. That decision got lost in an Air Forces fight against a parallel recommendation that the project be transferred to AEC.

A few weeks ago, Congress' Brewster committee recommended top priority for NEPA, but the outcome is still in doubt.

The only nuclear reactor in existence today capable of deliverying its energy output in usable form is the fast neutron reactor at Los Alamos, N. M. This unit, fueled with pure plutonium, employs no moderator. Essentially it is a controlled bomb.

"Watch-Charm Model"

This reactor went into operation in November, 1946. It delivers its energy at a fairly high, and therefore usable, temperature. It is described at Los Alamos as "a watch-charm model of a power plant." Its primary purpose is the study of bomb physics. But it is producing information which will be valuable if, as some expect, practical power plants turn out to resemble bombs more than they do the huge Hanford piles.

The second high-temperature pile due to come in is one at Brookhaven National Laboratory on Long Island. It is now under construction and should be completed next year. This may actually deliver a little electric power; AEC hasn't decided yet.

The decision is more a public relations than a technical one. The Brookhaven pile is simply a quickly-designed tool to produce neutron beams and perform irradiations. It is pretty much a copy of the existing pile at Oak Ridge—air-cooled, carbon moderated, fueled with natural uranium. However, it will operate at a higher power level than Oak Ridge's 1000 kw. Its cooling air will emerge hot enough to generate steam. The limit on its temperature is the heat-resistance of the aluminum jackets which protect the uranium from corrosion.

Space is being left in the design for a heat exchanger. But any power generated won't even be enough to run the wind-tunnel-size blowers that force cooling air through the pile.

The first reactor that can reasonably be considered a pilot plant for power generation is the Zinn pile at the Argonne National Laboratory in Chicago. Construction work on this only awaits final AEC approval. As a matter of fact, Argonne was ready to start a year ago. This will take a year and a half to two years to build.

The Zinn pile's primary purpose will be research, but it is being designed to do a workmanlike job of getting the power out in usable form. It will be a fast-neutron reactor using concentrated fuel, will operate at a fairly high power level and at a temperature comparable to that of a modern steam plant.

Two reactors specifically designed to produce electric power are on the AEC docket, but neither is in a very active condition.

Daniels Pile

One is the Daniels pile first projected by the Manhattan District in 1946 and then scheduled for completion this year. Like the Brookhaven pile, it was intended to be a modification of the Oak Ridge pile, run at a high enough temperature to generate steam.

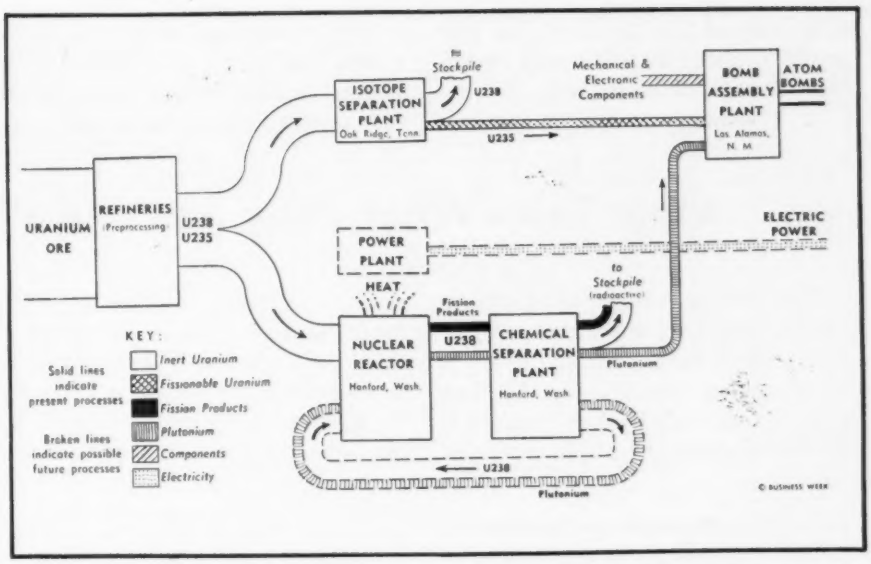
When AEC took over from the Manhattan District, it didn't think much of the Daniels pile, figured it was intended to produce publicity rather than knowledge. So this project has been in abeyance ever since. Desultory design work is being done, and this year, responsibility for it was transferred from Oak Ridge to the Argonne, where most pile work is being centralized. It is doubtful whether the Daniels pile ever will be built.

The other straight power project is the General Electric reactor, scheduled to be built at the Knolls Atomic Power Laboratory near Schenectady. No information has been furnished about this pile except that it will eventually run at a high enough power level to provide a practical demonstration of the operating problems to be expected in a commercial-size plant.

Design of the GE pile is now underway, but it is being held back by the expansion program at Hanford. The Knolls people have had to devote a large share of their attention to the research needs of the Hanford work, and it appears likely to be some time before construction of the Knolls pile can start.

During the past year, a number of the technical problems standing in the way of power production have come close to solution.

On the problem of a heat-transfer fluid, much was heard a year ago. Now it looks as if the Smythe Report's suggestion of liquid sodium, alloyed with potassium to lower its melting point, would turn out well. Sodium doesn't absorb neutrons, does not become seriously radioactive, has good thermal properties. It does react violently with water. However, a special heat exchanger has been developed — somewhat complicated but workable—to obviate trouble from this source.



CHEMICAL ENGINEERING FLOW CHART showing production and chemical separation of nuclear fuels. This is the atomic process assembly line from uranium ore to bombs, isotopes, and power. Broken lines show future possibilities

Separation Methods

Similarly, the elaborate chemical engineering studies involved in the design of the New Hanford plutonium plant are expected to work out separation methods basically applicable to power plants as well as to plutonium producers.

During the past year too, declassification of information on the breeding problem has clarified one fundamental question: Is nuclear fuel so scarce that atomic energy must always be regarded as a special-purpose affair to be rigidly conserved? Or is it plentiful enough to be regarded as a major power resource

Uranium itself is a fairly plentiful metal. However, only one part in 140 of it is naturally fissionable. If that were all, atomic energy would be a rarity very soon.

But when fissionable U235 is consumed in a reactor, producing power in the process, some of the U238 is transmuted into fissionable plutonium. This increases the potential supply of fuel.

Then the question is: When you burn a pound of U235, how much plutonium do you get? Suppose you only got half a pound. Burning that half pound would produce a quarter pound, and so on. You'd end up able to use only one part in 70 of the total uranium. Still not good.

But suppose you get a pound of plutonium out for each pound of fuel burned. Then you can eventually utilize all the uranium. And if you could get out more than a pound of plutonium, you'd have a "breeder pile" which constantly would produce extra fuel for use in other piles.

The same question applies to thorium, which is more plentiful than uranium. Exposed to a chain reaction, thorium is transmuted to fissionable U233. If at least one-to-one breeding is possible, this fact adds thorium to the potential energy supply. Otherwise it is just a scientific curiosity.

Breeding Potential

So what about breeding? Theoretically, it is possible: When a U235 atom splits, it throws out, on the average, something over 2.2 neutrons. One of these is needed to split another U235 atom and keep the chain reaction going. If another neutron is used to transmute a U238 atom into plutonium, that leaves a margin for losses—if the losses themselves are small enough.

AEC's guarded comments indicate that in present piles the neutron losses are too great to permit breeding. But

it is believed that the new piles now on the drafting boards would be efficient enough to breed fuel.

If it works out, it makes atomic energy a thousand-year resource or better. And people who like to worry about the fate of their descendents fifty generations away can take comfort from this thought: Though there is no reason to look for coal or oil there, the moon should have lots of uranium and thorium.

Atom Talk—What They Say and What They Mean

The businessman who wants to keep a prudent eye on the progress of atomic energy doesn't need to study nuclear physics. But he does need to know what its raw materials are, its products, the major processes. So here is

A Businessman's Glossary Of Atomic Energy Terms

Atom: The smallest chunk of matter which has normal chemical properties. It is made of a few elementary kinds of particle, formed into a heavy nucleus with a positive electric charge. The nucleus is surrounded by an almost weightless cloud of negative electricity. All the chemical behavior of matter results from properties of this negative electricity. The nucleus is unaffected by any chemical process.

Atom bomb: Essentially a gun and target. The gun's projectile is a subcritical mass of fissionable material. So is the target. When the two come together, a critical mass is formed and an explosion occurs.

Breeder pile: Any reactor in which the amount of fissionable material produced by transmutation exceeds the amount consumed in the chain reaction.

Control rods: The equipment by which a chain reaction is controlled. Bars of material, usually boron steel, which absorbs neutrons. When the bars are inserted into the reactor they slow or stop the chain reaction.

Coolant: Fluid used to remove the heat generated in a reactor. Air or water is used in existing reactors. Future high-temperature reactors may use helium or liquid metals such as sodium or mercury.

Critical mass: When one atom in a chunk of fissionable material splits, it emits several neutrons. Some will be absorbed in non-fissionable material, some will escape through the sides of the chunk. For a chain reaction at least one must be left to cause another fission. In a small chunk, too many will escape through the sides. As the chunk is enlarged, the mass increases as the cube of the diameter, the surface only as the square. So the proportion of neutrons escaping decreases. At "critical mass" just enough neutrons are left to sustain a chain reaction. Critical mass in a natural uranium carbon pile is on the order of tons. In pure U235, according to Werner Heisenberg, the German physicist, it is around 20 pounds—baseball size.

Electron: A sub-atomic particle with a unit negative charge and very little mass.

Enriched material: Uranium containing a higher than normal proportion of U235.

Fast neutron reactor: A reactor fueled with enriched material so that no moderator is needed.

Fission: Splitting of an atom into two atoms of more or less equal weight.

Fission chain reaction: A fissionable atom splits when it absorbs a neutron. In splitting it throws out more neutrons which cause further splitting in a continuing or increasing chain.

Fissionable material: A kind of atom which will split when it absorbs a slowly moving neutron. Those known are uranium 233, uranium 235, and plutonium.

Fission product: Atoms formed by the broken pieces of a split atom. Usually very radioactive.

Geiger counter: An instrument for detecting radioactivity.

Half-life: In a mass of radioactive material, the activity dies away but never disappears completely. Starting at any moment, half the activity will disappear in a certain definite time, say an hour. Half the remaining activity will disappear in the next hour, and so on. Then the half-life would be an hour.

Isotope: A particular combination of neutrons and protons forming an atom nucleus. Several isotopes of different weight may have the same electric charge. Then they have identical chemical properties and are called isotopes of the same element.

Moderator: Material built into a reactor to slow the neutrons emitted in fission. Slow neutrons are less likely to be captured by U238, so more neutrons are available to sustain the chain reaction in U235. Common moderators are graphite, beryllium, heavy hydrogen.

Pile: Same as a reactor. Most often used for a slow-neutron reactor in which slugs of uranium are surrounded by a moderator.

Neutron: A heavy sub-atomic particle with no electric charge.

Nucleus: See "atom".

Proton: A heavy sub-atomic particle with weight close to a neutron and electric charge equal to an electron but positive.

Radioactivity: Emission of energy by an atom—either as high-speed particles or as energy waves.

Radio-Isotope: An unstable isotope which shifts itself to stable form by spitting out particles of its nucleus, electrons, or energy waves.

Reactor: Any device in which a fission chain reaction can be maintained.

Shielding: Heavy material, often concrete or lead, placed around a reactor or radioactive material to absorb the dangerous radiation.

Transmutation: Artificial conversion of an atom of one element into an atom of another element. Accomplished by hitting the atom with a sub-atomic particle.

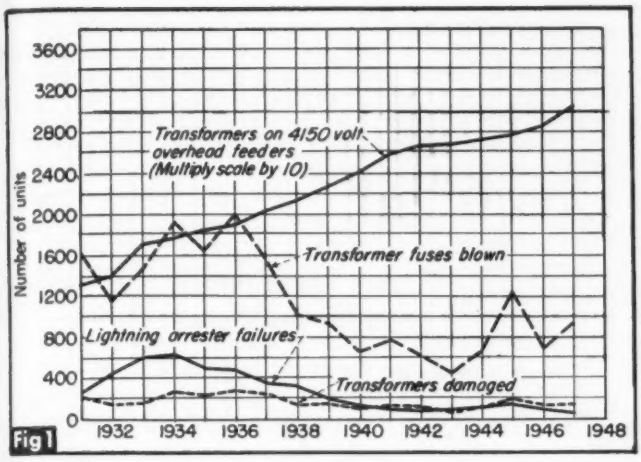


Fig 1

REDUCED LIGHTNING TROUBLES on the 4,150-v system reflect improved grounding, better arresters and new transformers

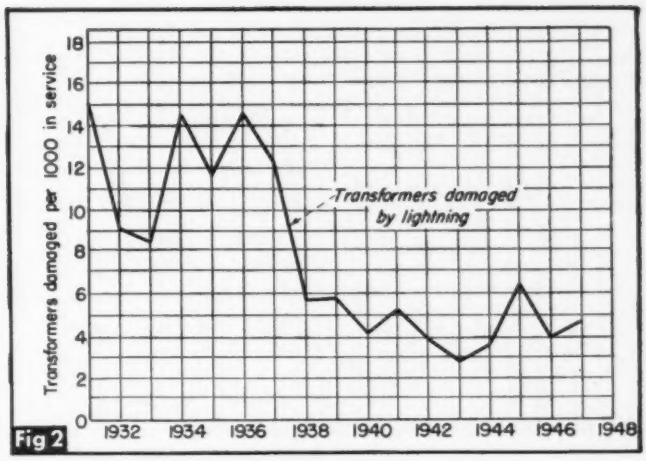


Fig 2

TRANSFORMER DAMAGE RATE due to lightning on the 4,150-v system dropped due to improved designs

17-Year Lightning Study Gets Results

G. W. MAIHL
Electric Test Department
Consolidated Gas Electric
Light & Power Co of Baltimore

Baltimore utility evaluates steps taken since 1931 to reduce lightning trouble on transmission and distribution circuits. Performance records are cited to show improvement

DEVELOPMENTS that have contributed the most to the improvement of lightning protection on the system of the Consolidated Gas Electric Light and Power Co of Baltimore fall into six categories:

1—use of reduced rating lightning arresters on 13.2-kv equipment

2—application of protector tubes for insulator protection on high voltage feeders and air break switches on transmission circuits

3—location of lightning protection devices close to equipment

4—reduction of ground resistances

5—evaluation and coordination of insulation levels

6—modernization of protective equipment

Since 1931 an engineering committee* representing operating departments of the company has conducted a continuous study of lightning protection methods. This article is a summary of the developments and experience gained in lightning protections as a result of this study.

Territory served by the company embraces some 2,300 sq mi. Transmission lines operating at 110,000 v supply large substations in suburban and outlying areas. Overload distribution feeders at 13,200 and 33,000 v from these substations supply high-voltage customers and smaller substations that step down to 4,150 v. In and near Baltimore, loads are generally served by 13,200-v underground feeders from local generating plants to 4,150-v distribution substations. A 4,150-v 3-phase, 4-wire system is used for local distribution. Except for certain 33,000-v feeders all these systems are operated with transformer neutrals solidly grounded.

Until 1931, arresters with a maximum rating of 15,000 v, phase-to-ground were used to protect 13,200-v equipment on the Baltimore system.

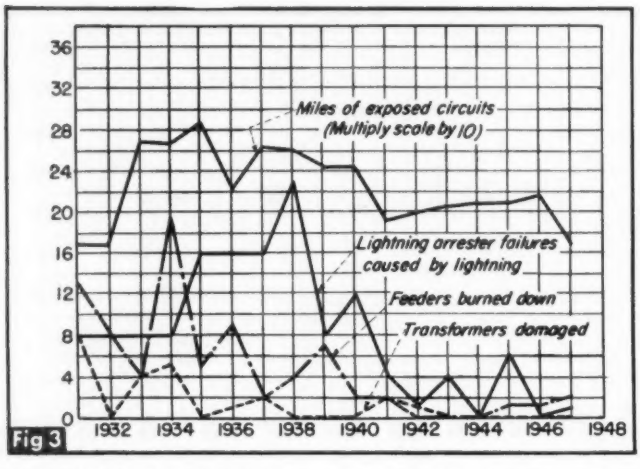
Studies of system-voltage stability showed that in many cases arresters with a 9,000-v maximum phase-to-ground rating would give improved protection. Accordingly existing 15,000-v arresters were reconnected for a 9,000-v rating. They proved successful in protecting equipment of low impulse strength. While regular 9,000-v arresters also provided good lightning protection, they had relatively little margin between their spillover and operating voltages.

Gradual improvements in the surge-strength of equipment, accompanied by improvements in the protective ability of arresters, made continued application of 9,000-v arresters unnecessary. Therefore, beginning in 1939, arresters with a 12,000-v rating were adopted for protection of all new 13,200-v equipment. Present policy is to replace 9,000-v arresters with 12,000-v units whenever system changes are made.

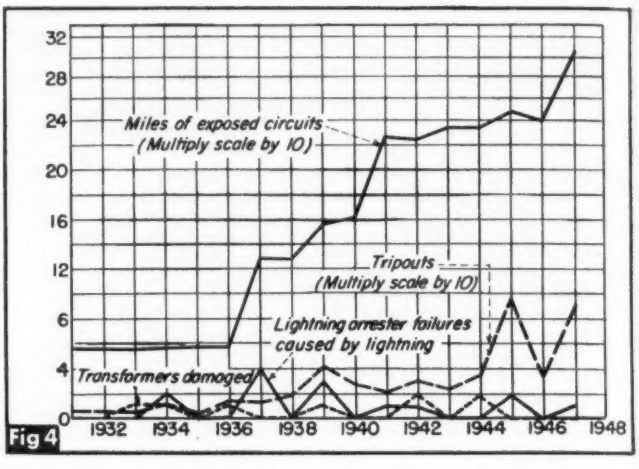
Protector tubes were first installed on the Baltimore system in 1935. They were initially installed on every other pole of several important 13,200-v feeders. In the years that followed, as the efficacy of tubes became evident, they were applied on every third pole, every fourth pole and every sixth pole of other feeders. Experience indicates that every fourth pole is the most economical spacing consistent with protection rendered.

Use of tubes on overhead feeders as supplementary protection for important underground cable terminals was begun in 1938. Here, tubes were

* As Secretary of the Lightning Protection Committee, the author respectfully makes acknowledgement to present and former members under whose supervision these studies were conducted: H. C. Louis, chairman, M. A. Polster, J. M. Towner and L. C. Smith, past chairman.



PERFORMANCE RECORD by years for the 13,200-v system shows steady rate of system improvement



INCREASED EXPOSURE on the 33,000-v system caused no appreciable increase in the lightning troubles

installed on every pole or every other pole within a quarter mile of junctions between cable and overhead lines. These tubes relieved the duty on lightning arresters at the cable terminals. As a result, cable troubles due to lightning have been reduced. Similar tube applications have since become common on 13,200-, 26,400- and 33,000-v feeders.

A unique and successful application of tubes has been made for the protection of air-break switches on 110,000-v circuits. Theory and experience showed that open switches were reflection points for surges that made them vulnerable to flashovers during lightning storms. All air-break switches on 110,000-v circuits directly exposed to lightning surges have been equipped with such tubes.

Operating experience with protector tubes has led to several significant findings:

1—Expulsion action of tubes, particularly those with a single discharge vent, produce strong reaction forces. Mounting brackets must have sufficient strength to resist distortion.

2—A $\frac{3}{4}$-in. external air-gap setting on 13,800-v tubes cannot be maintained in service. Field conditions sometimes reduce this gap enough to make it arc over. The fibre insulation is then subjected to prolonged voltage stresses. Tubes are carbonized by leakage current and eventually flash over externally. Increasing the setting on 13,800-v tubes to $1\frac{3}{8}$ in. stopped this trouble without appreciable loss of tube protective ability.

3—Tubes with low current ratings in areas of very low ground resistance may burst if subjected to fault currents beyond their interrupting capacity. Conversely, those with high current rating in areas of high ground resistance may fail to clear because fault current may be too low to give proper expulsion action. It is necessary therefore to select tubes with proper interrupting ratings to coordinate with system fault currents at specific locations.

4—It is not practicable to apply tubes in very dirty or chemically contaminated areas. Leakage currents over equipment when wet interfere with normal tube operation.

5—Useful life of a protector tube should be determined by erosion of the bore due to expulsion action, rather than number of discharges.

Both theory and experience show that to be effective, arresters and protector tubes must be applied close to equipment. This is especially important on low voltage and 4,150-v apparatus. In general protective devices are located so as to afford the greatest degree of protection for the most important equipment. They should be arranged so they can not be disconnected by switching operations.

Reducing Ground Resistance

Efforts to improve grounds in substations have consisted of inter-connecting lightning arrester grounds with other equipment grounds, entrance cable sheaths and water systems where possible. Where no water system exists, interconnected equipment is tied to driven rods, salted to reduce resistance. Ground resistances are measured periodically and have been reduced to five ohms.

On transmission circuits, particularly in areas of high soil resistivity, reduction of ground resistances by driving and salting ground rods has been largely superseded by counterpoises or wires buried 12 to 24 in. in the ground along the right of way. Both radial and continuous parallel counterpoise construction has been used. On 110,000-v structures, ground resistance is kept under 15 ohms.

On 4150-v feeders, various schemes have been devised for interconnecting arrester grounds and secondary neutrals. While interconnection provides ground resistance for arresters and gives better protection, later experience shows that the same improvements can be realized by lowering arrester ground resistance without interconnections. Intensive work has resistance.

Coordinating Insulation Levels

Extensive tests have been made at the Locke Insulator Corporation high voltage laboratory to evaluate the impulse strength of typical full scale wood-pole structures.

These tests showed that impulse flashover values of unguyed poles are lower between the insulated phase wires than between phase wires and ground. On guyed poles, it was found that impulse levels to ground can be made as high as impulse levels between phase wires, by properly arranging guys with wood breakers.

Other improvements worked out and adopted from these tests included: use of wood crossarm braces instead of steel; maintenance of adequate air clearance; application of protector tubes coordinated with line insulation to prevent insulator flashover, and

use of instrument transformers having higher impulse levels on overhead feeders than on underground cables.

When the 66,000-v transmission system was changed over to 110,000-v, insulator string lengths were adjusted so that flashover values of the insulators balanced those of the air clearances between the conductors and the structures.

Modernizing Protection Equipment

Adoption of improved protective devices as developed by the industry, has probably done more to further lightning protection than any other factor. Modernization programs, during the last 17 years, have centered around industry improvements of lightning arresters and protector tubes, replacement of arresters having design defects, system changes, and the use of distribution transformers with coordinated gaps.

Operating Records Show Improvement

Effectiveness of lightning protection in reducing troubles is shown on performance records for the various voltage systems during the last 17 years. These records have been summarized on the accompanying charts.

Principal lightning troubles that have affected the operation of the 4,150-v distribution system are shown in Fig 1. This chart shows how the number of distribution transformers has grown on exposed overhead feeders. It also shows the number of primary fuses blown, lightning arrester failures, and transformers damaged. Until 1936, transformer fuses were blown at a rate of about one out of ten transformers per year. A three-year program of lowering ground resistance later reduced the number of lightning troubles. Failures of early, enclosed-gap arresters were frequent until 1934. Subsequent improvements in arrester design by the industry, and reduced arrester ground resistance connections, substantially decreased arrester failures.

Fewer distribution transformers were damaged by lightning after 1936, although more transformers were in service. This improvement in transformer performance is evident in Fig 2, which shows the number of transformers damaged annually per thousand in service. Before 1936, about 12 transformers per thousand were damaged each year. This rate has dropped to about 4 per thousand since 1941. This improved performance is attributed to new transformers with coordinated insulation, to reduced arrester ground resistances, and to improvements in the design and application of lightning protective devices.

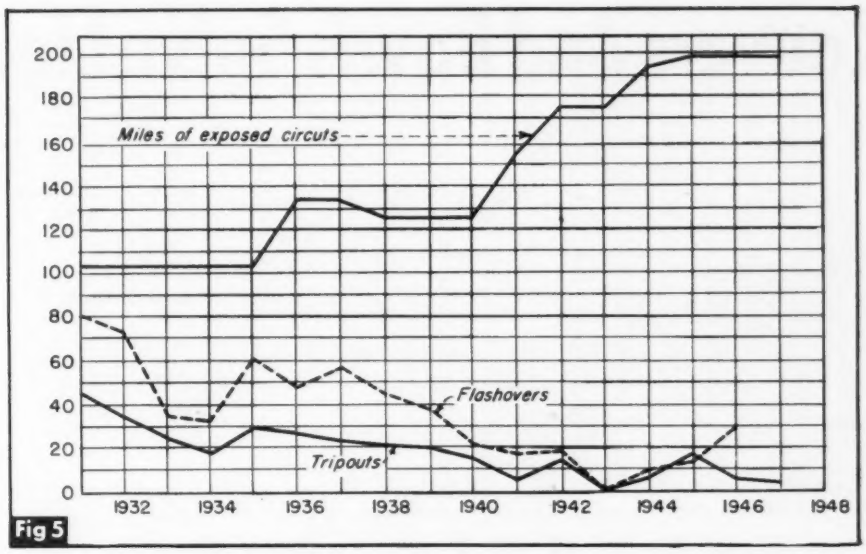


Fig 5

ON 66-KV AND 110-KV CIRCUITS reduced ground resistance, better shielding and improved structure design brought fewer lightning troubles

Performance of the 13,200-v system is charted in Fig 3. Since 1937, as more and more 13,200-v feeders supplying outlying sections were converted to 33,000-v operation, system exposure has decreased. Annual arrester failures from lightning nearly doubled from 1935 to 1938 when many 9,000-v arresters were installed to protect equipment with low insulation strength. But in the same period less than half as many transformers were damaged annually. After 1938, better arrester and transformer designs, and the use of 12,000-v arresters instead of 9,000-v units, brought marked reductions in arrester failures and damaged transformers. Since 1941, lightning has caused about three arrester failures per year and over the seven year period through 1947, only three transformers have been damaged.

Lightning troubles on the 33,000-v system are shown in Fig 4. Some of these feeders are operated with transformer neutrals solidly grounded, others with neutrals ungrounded. As this chart shows, tripouts caused by lightning or failure of protective devices have increased since 1936 but not nearly in proportion to system growth. Increased tripouts are attributed to two factors. First, more 33,000-v feeders have been operated in rural territory where effects of lightning storms are more severe. Second, all 33,000-v feeders in rural territory were operated without transformer neutrals solidly grounded. Ungrounded neutral operation necessitates the use of 37,000-v arresters which afford about 25% less protection for equipment than the 30,000-v arresters used on grounded-neutral feeders. There have been more arrester and equipment failures on ungrounded neutral feeders than on grounded-neutral feeders.

Flashover and tripout data on 66,000-v and 110,000-v transmission circuits is plotted against system exposure in Fig 5. These circuits were operated at 66,000-v until October 1937, when they were modified for 110,000-v operation. By 1948 there were almost twice as many miles of exposed transmission circuits as in 1931. Although the system exposure has practically doubled, flashover and tripouts have decreased since 1935. This improvement was brought about in several ways:

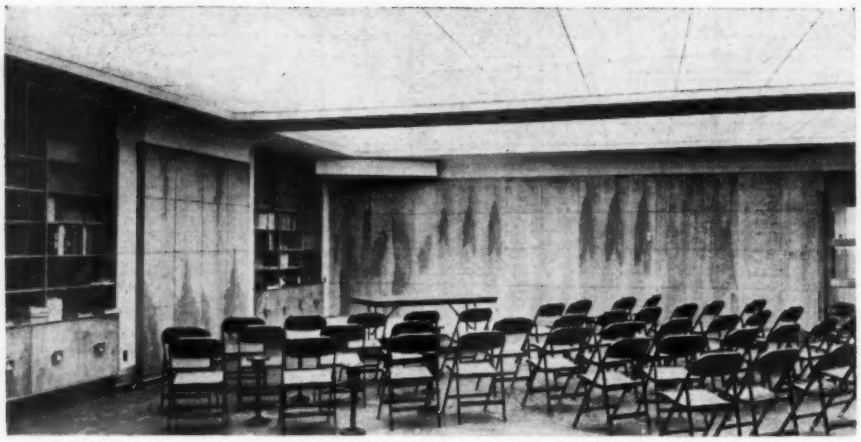
1—reducing ground resistance to 15 ohms or less

2—installing overhead ground wires on exposed circuits and relocating existing ones

3—incorporating design features found conducive to good lightning performance into the construction of circuits added to the system.

Louvers And Bowls Solve Lighting Problem

HOWARD M. SHARP
Consulting Engineer
Snyder, N. Y.



ABOVE THIS LOUVERED CEILING are silver-bowl lamps and a maze of piping

Piping network suspended from ceiling, need for accessibility and appearance, and definite budget limitations jointly contribute to difficulty of adequate lighting installation

SILVER-BOWL INCANDESCENT lamps above a louvered ceiling solved a tricky problem of lighting in a new plant built by the Williams Gold Refining Co, Buffalo, N. Y. An area on the ground floor containing a lecture room and a small private dining room, were to be lighted in an effective and pleasing manner. The two rooms were separated by a partition that could be folded back when occasion required. The lighting thus had to be the same in the two rooms and be suitable to both uses. Freedom from direct and reflected glare was highly desirable as was flexibility in light quantity without sacrifice of appearance.

LOUVER APERTURES are large enough to allow lamp replacement through them

Complicating the problem was a network of piping hanging from the ceiling. On the floor above were laboratory and refining areas from which the piping carried valuable and highly corrosive wastes to reclaiming processes in the basement. It was imperative that the piping be easily accessible for inspection and maintenance. It should be kept as clear as possible. And for the sake of appearance it should be concealed.

Louver Application

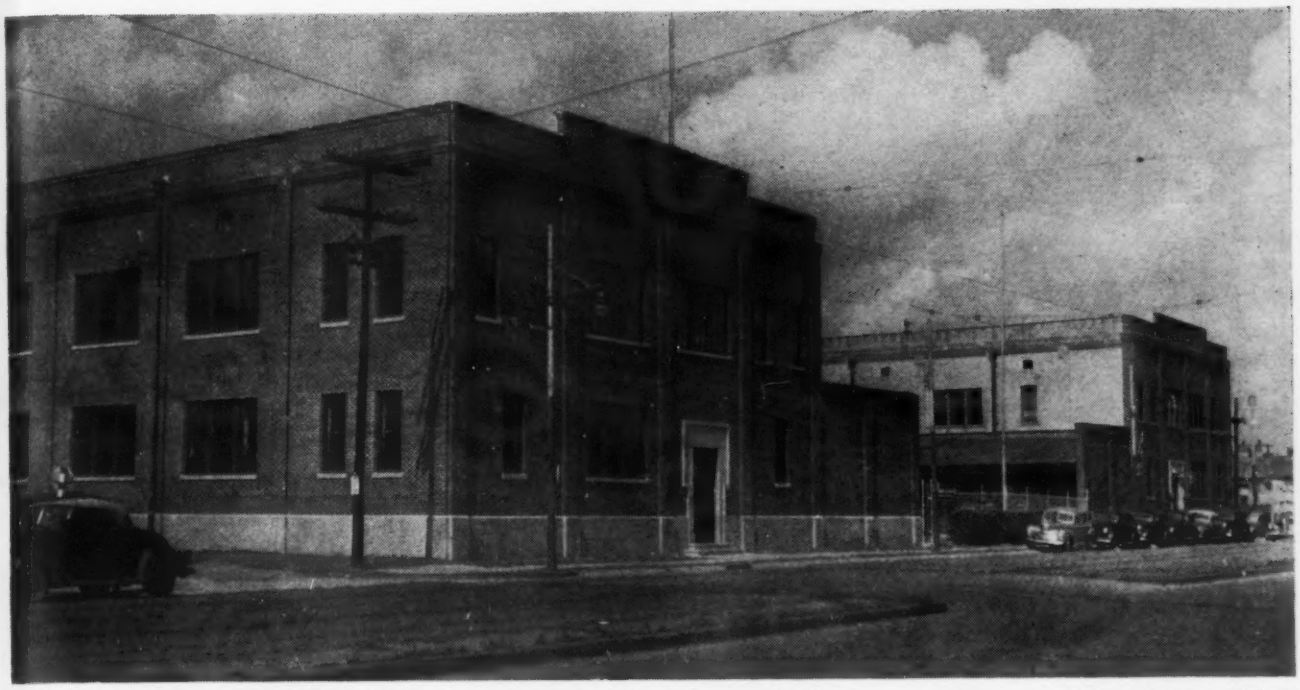
Cost of the lighting installation was an important factor. The lecture and dining rooms would not be in continuous use and the capital investment in them should not be high.

Obviously, a louvered ceiling was indicated. But not just any louver. Its design should be in scale and form to harmonize with the dimensions of the rooms and with their uses. Depth should be sufficient to hide the piping, beams, and lighting equipment above. Coordination of the lighting design with these requirements was facilitated by the understanding cooperation of the architect, John Y. Sloan and the structural engineer, John H. Beane, both of Buffalo.

Solution was found in louvers 4 in. square and 4 in. deep, providing shielding of 45 deg, in sections 2 ft wide, 5 ft long. To keep the piping as clear as possible and to reduce investment, incandescent lamps were used instead of fluorescent. The 200-w lamps could be replaced through the louver apertures. Lamps were spaced on approximately 4-ft centers and hung at an average 18 in. below the ceiling.

Low Cost Design

In round numbers the cost worked out to $3 per sq ft for the louvered steel ceiling and 20c per sq ft for lamps and wiring, exclusive of feeder capacity and service apparatus outside the room. After 7 months use intensity was 31 ft-c average at chair level; louver brightness, 25 ft-L; walls, 4 ft-L; and floor, 6 ft-L. Louvers and ceiling above are white, walls are honey-colored birch, and floor mottled green asphalt tile. Measurements show louver absorption of 35%. Coefficient of utilization for the lecture room was calculated at 32% at first turn on; after 7 months use it is 22%. As times goes on, the coefficient will average out to perhaps 16%, with brightness mitigated and illumination generously adequate for the purposes of the rooms. This unique installation resulted in an extremely attractive ceiling treatment and at the same time kept the overall costs of the installation within a reasonable figure.

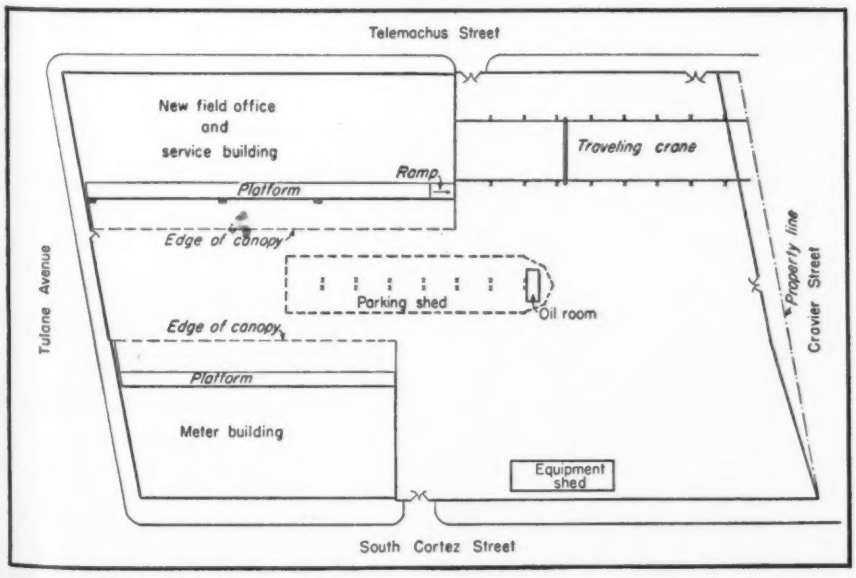


TWO BUILDINGS ARE IDENTICAL in exterior appointments. This results in a pleasing appearance to property at present time and lends itself to joining of two buildings at later date. The old meter building (right) was completed in 1929

Everything Designed For Service In New Utility Service Building

New structure designed to eliminate waste time and labor of office and field forces. Convenience the keyword. Utilizes layout and equipment already proven in plants

IVAN H. PURINGTON
Operating Research Engineer
New Orleans Public Service, Inc
New Orleans, La.



NEW SERVICE BUILDING is located at one corner of property and may later be connected to meter building. Large transformer and storage yard served by traveling crane which extends 15 ft outside of the fence for unloading from flat cars when spur line is built. Vehicle gates give entrance to yard from three streets having less traffic than Tulane Ave

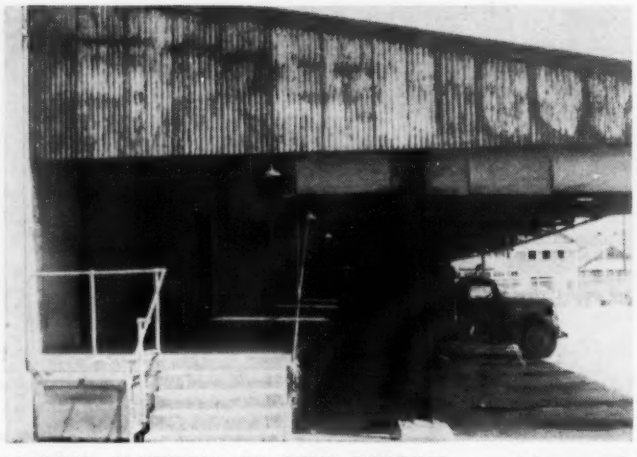
TIME AND SWEAT are rising in price on the labor market. We decided to design them out as much as possible in planning our new service building. This type of building is a highly specialized unit. Its usefulness is increased if its design is geared to the tasks to be performed. Thus management, the heads of the departments involved, and the architect had to coordinate their thinking closely in the early planning stages.

The success of this planning is evidenced by the enthusiasm of both management and workmen in the new building now going into service. Time and labor will be saved by:

1—General Layout

(a) offices and store room, shop or service area located adjacent to each other to make for convenience and to minimize foot traffic

(b) each section supplied with necessary single and 3-phase power, air, gas, and water services as re-



LOADING PLATFORM OF NEW BUILDING on right greatly improved over meter building on left. Ramp replaces steps; columns along edge of platform leave truck area clear; and sprinkler drain pipes are in the roof truss giving more head room

quired to make it independent

(c) loading platform runs complete length of building. Full width ramp at rear facilitates movement of equipment to and from yard level

(d) columns supporting loading platform roof are placed at edge of floor leaving truck area clear

(e) lighting installation designed according to needs in office, store room or work area

(f) adequate size entrances and exits in all places

2—Equipment Installed

(a) 10-ton crane serving storage yard and 6-ton crane serving transformer pit

(b) monorail track serving complete length of loading platform and line section equipment room as well as the shops

(c) reversible conveyor belt between first and second-floor store rooms

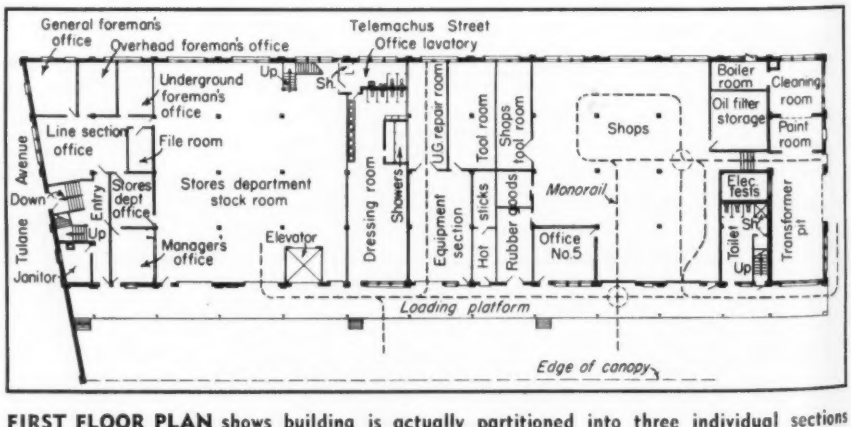
(d) elevator

(e) hot-stick hanging racks

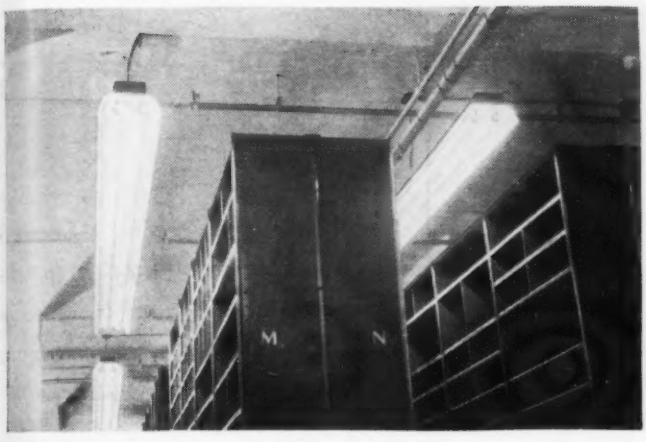
The new structure houses the line section (construction and maintenance of distribution circuits other than services); the shops section (testing and repairing of transformers and portable equipment); the stores section (supplying distribution materials); and the assembly room for the distribution department.

Each group was allowed sufficient floor space to operate efficiently, both now and in the foreseeable future. Details such as scales, compressed air, single and 3-phase power, transformer oil supply points, etc were supplied to each group and area.

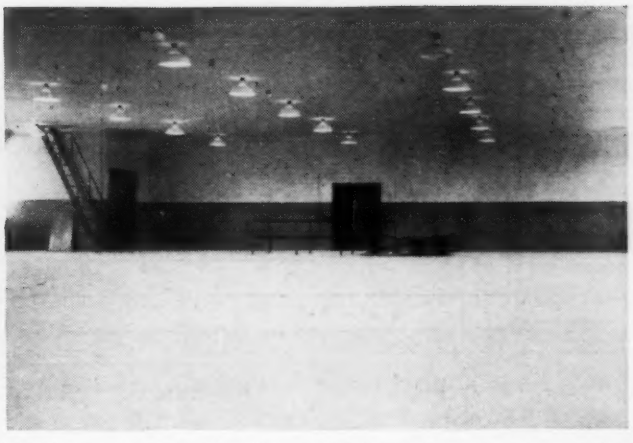
REVERSIBLE CONVEYOR belt is used to move stock, coils of wire, outer globes, etc., to and from the second floor. It is 48-in wide, travels 60 fpm, has a capacity of 50 lb per lineal foot, and is driven by a 3-hp motor through a worm and chain reduction



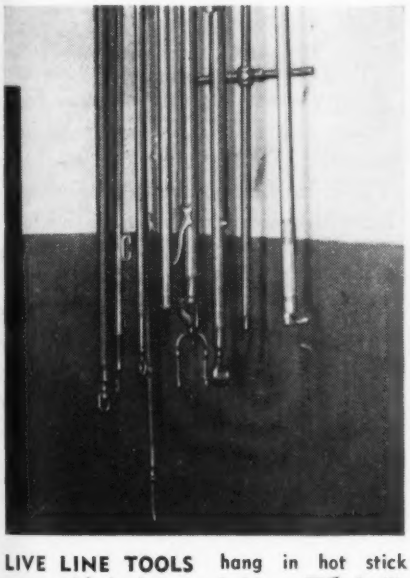
FIRST FLOOR PLAN shows building is actually partitioned into three individual sections —one for stores department, one for lines department and one for shops. Sole exception is line section office which is located in front to minimize foot traffic and to be convenient to stores department office and stock room. Second floor has room for distribution office which will be moved there later, stores stock room for less frequently used apparatus, and an assembly room which is equipped with complete kitchen



STOCK BINS (left) are flooded with light from continuous rows of fluorescent units mounted 2 in. above the bin tops . . . Second floor stock room (right) utilizes incandescent fixtures of glass-steel type



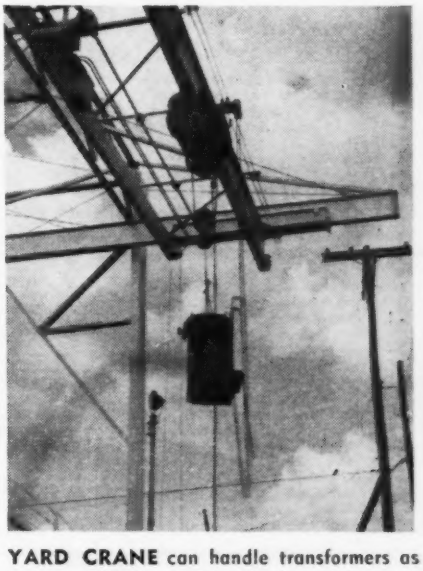
Odd fixture at top left is a "house light" and is on same independent service as exit lights; burns continually. All exit and house lights have two lamps per fixture, each on separate circuits



LIVE LINE TOOLS hang in hot stick rooms with business end down. This facilitates picking correct stick

TRANSFORMER PIT has 17 x 17-ft door permitting truck to back in with unit. Also has 6-ton crane, and pulling eyes in floor opposite door and at end of room for handling large transformers that are brought in for servicing

WITHIN TRANSFORMER PIT, leads are brought from test apparatus through bushings. When not in use all leads are grounded. Oil lines, without hoses attached and control switches are located just left of the transformer, against the wall



YARD CRANE can handle transformers as much as 15 ft outside the fenced-in yard. This aids operations considerably

New Lamps

Combination of E-H1 mercury-arc lamp, with luminaire specifically designed for it, allows greater utilization of output from higher efficiency light source

DANA W. ROWTEN*
Westinghouse Electric Corp
Cleveland, Ohio

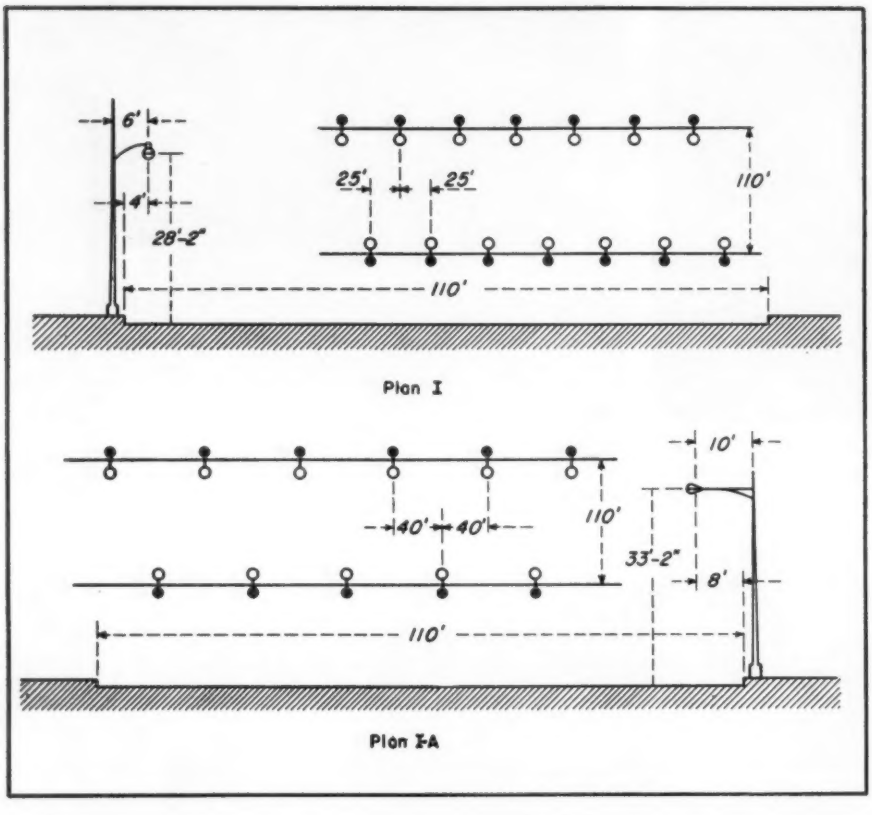


TABLE I—Cost of Lighting Comparison For Equal Maintained Illuminations

This estimate is based upon the assumption of lighting a given street 110 ft in width on which there are no restrictions as to spacing and mounting height. This comparison illustrates the merits of two mercury vapor layouts each designed to produce an average maintained illumination level of 1.5 ft-c

GENERAL LAMP DATA	PLAN I	PLAN I-A
1—Type of lamp	F-H1	E-H1
2—Initial lumens	16,000	20,000
3—Lamp lumens maintained (calculated at 500-hr, intervals)	13,800	16,800
4—Burning position	Vertical	Horizontal
5—Lamp operating hours in service	6,000	3,000
6—Spacing (staggered)	25 ft	40 ft
7—Mounting height	28 ft 3 in.	33 ft 3 in.
8—Luminaires required per 1000 ft	40	25
ANNUAL FIXED CHARGES		
1—Total cost of equipment installed	$10,579.00	$8,176.00
2—10% of initial for amortization	1,058.00	818.00
3—5% of initial for interest and taxes	529.00	409.00
"A" Annual Fixed Charge (line 2 + line 3)	$1,587.00	$1,227.00
ANNUAL COST OF MAINTENANCE		
1—Lamp cost (list price less 30%)	$7.35	$11.90
2—Labor cost to renew one lamp*	.50	.55
3—Cost to renew one lamp (line 1 + line 2)	$7.85	$12.45
4—Renewals per year $\frac{\text{annual operating hours (4000)}}{\text{lamp operating life}}$	.67	1.30
5—Annual lamp renewal cost (line 3 × line 4)	$5.26	$16.19
6—Cost patrolling, washing twice per year, and minor repairs and replacements*	3.72	3.72
7—Cost of maintenance per year per unit (line 5 + line 6)	$8.98	$19.91
"B" Annual Cost of Maintenance (line 7 × total units)	$359.20	$497.75
ANNUAL COST OF POWER		
1—Rated watts per lamp	400	400
2—Losses for multiple-service ballast	42	47
3—Total watts lamp and ballast	442	447
4—Misc. line losses (10% of line 3)	44	45
5—Total watts per unit	486	492
6—Annual kwhr per unit (Bw × 4000)	1944	1968
7—Cost of power per unit per year (kwhr × rate assumed at 1¢)	$19.44	$19.68
"C" Annual Cost of Power (line 7 × total units)	$777.60	$492.00
"D" Total Annual Cost of Lighting (line "A" + "B" + "C")	$2,724.00	$2,217.00
"E" Relative Cost of Lighting Per 1000 Ft. Per Year	100.0	81.4

* The unit costs indicated for each of these are from an annual statement of costs for such service as experienced by one of the largest utility companies.

TWO OF THE MOST POPULAR mercury street-lighting sources today are the E-H1, 20,000-lumen lamp and the F-H1, 16,000-lumen lamp. The E-H1 lamp operates at roughly twice the vapor pressure of the other and has a somewhat shorter arc length. Both lamps are rated at 400 w. The 20,000-lumen lamp can be burned in any position. A new luminaire has been developed to operate this lamp in a horizontal position. This provides more accurate control of the light output than is possible with the 16,000-lumen lamp operated in a vertical position. The rated average life of the 20,000-lumen, E-H1 lamp is 3,000 hr as compared with 6,000 hr for the F-H1 lamp.

Lighting Layout

Table I is an estimate based on the assumption of lighting a given street, 110 ft in width, on which there are no restrictions as to spacing and mounting height. The two mercury-vapor layouts are each designed to produce an average maintained illumination level of 1.5 ft-c on the roadway. It will be seen that when all the annual fixed, maintenance, and operating costs are included, the 20,000-lumen, E-H1 lamp with the OV-20 luminaire is nearly 20% less costly per year than the 16,000-lumen lamp and luminaire.

In making any comparison between the F-H1 and EH1 lamps, each

* Section Engineer, Street Lighting Application, Lighting Division, Cleveland, Ohio.

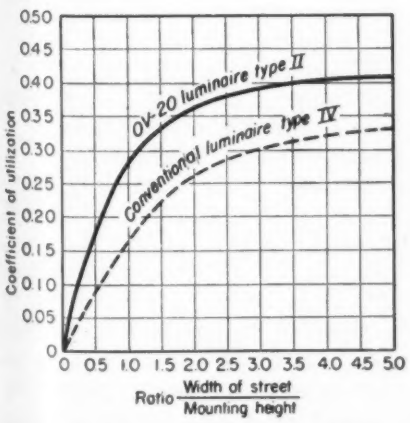
Reduce Costs

should be combined with the luminaire with which it is used in common practice. Contributing to the higher efficiency of the 20,000-lumen lamp shown in Table I is the greater utilization factor obtainable from the OV-20 luminaire. Almost all of the F-H1 lamps have been used in a Type IV luminaire designed for a small incandescent light source. This misapplication results in an average utilization of approximately 30%. This compares with approximately 40% utilization possible through greater control of the horizontally-burning E-Hl lamp in the newly designed luminaire.

Lamp Demands

One of the greatest demands for mercury vapor lamps is for direct replacement for existing equipment where spacing between luminaires is fixed as in the case of existing street railway poles. A comparison of costs is desirable under these restricted conditions.

Table II is based on the assumption of relighting a given street 110 ft in width on which street railway poles are installed. It is proposed to make a direct replacement of present units. The relative cost per average maintained footcandle on the roadway shows over 20% advantage for the 20,000-lumen, E-Hl lamps and OV-20 luminaires.



E-H1 LAMP in OV-20 luminaire has higher coefficient of utilization than conventional lamp and luminaire

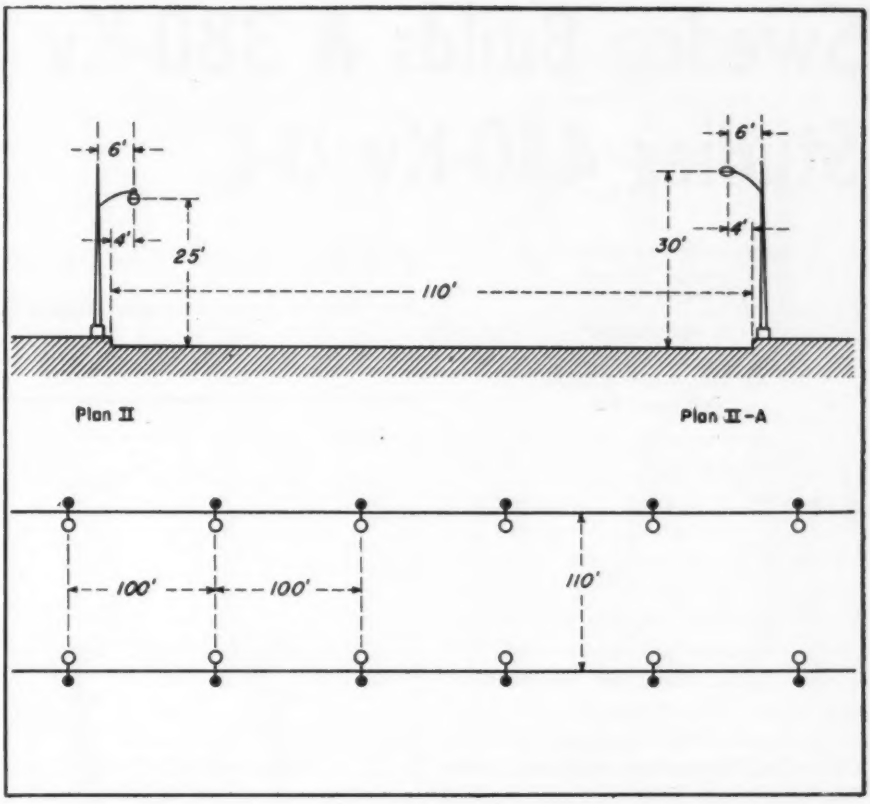


TABLE II—Cost of Lighting Comparison For Equal Spacing

This estimate is based on the assumption of relighting a given street 110 ft in width on which street-railway poles are installed. It is proposed to make a direct replacement of present units. This comparison illustrates the merits of two mercury vapor systems as follows:

GENERAL LAMP DATA	PLAN II	PLAN II-A
1—Type of lamp	F-H1	E-H1
2—Initial lumens	16,000	20,000
3—Lamp lumens maintained (calculated at 500-hr intervals)	13,800	16,800
4—Burning position	Vertical	Horizontal
5—Lamp operating hours in service	6,000	3,000
6—Luminaires required per 1000 ft	20	20
ANNUAL FIXED CHARGES		
1—Total cost of equipment installed	$2,926.00	$3,220.00
2—10% of initial for amortization	293.00	322.00
3—5% of initial for interest and taxes	146.00	161.00
"A" Annual Fixed Charge (line 2 + line 3)	$439.00	$483.00
ANNUAL COST OF MAINTENANCE		
1—Lamp cost (list price less 30%)	$7.35	$11.90
2—Labor cost to renew one lamp*	.50	.55
3—Cost to renew one lamp (line 1 + line 2)	$7.85	$12.45
4—Renewals per year $\frac{\text{annual operating hours (4000)}}{\text{lamp operating life}}$	.67	1.30
5—Annual lamp renewal cost (line 3 × line 4)	$5.26	$16.19
6—Cost patrolling, washing twice per year, and minor repairs and replacements*	3.72	3.72
7—Cost of maintenance per year per unit (line 5 + line 6)	$8.98	$19.91
"B" Annual Cost of Maintenance (line 7 × total units)	$179.60	$398.20
ANNUAL COST OF POWER		
1—Rated watts per lamp	400	400
2—Losses for multiple-service ballast	42	47
3—Total watts lamp and ballast	442	447
4—Misc. line losses (10% of line 3)	44	45
5—Total watts per unit	486	492
6—Annual kwhr per unit (Bw × 4000)	1944	1968
7—Cost of power per unit per year (kwhr × rate assumed at 1¢)	$19.44	$19.68
"C" Annual Cost of Power (line 7 × total units)	$388.80	$393.60
"D" Total Annual Cost of Lighting (line "A" + "B" + "C")	$1,007.00	$1,275.00
"E" Average Maintained Footcandles	.76	1.24
"F" Cost Per Footcandle	$1,325.00	$1,028.00
"G" Relative Cost Per Footcandle	100	77.6

* The unit cost indicated for each of these are from an annual statement of costs for such service as experienced by one of the largest utility companies.

Sweden Builds A 380-Kv Line—Studies 440-Kv D-C

Summarized translation from
Teknisk Tidskrift
March 1947

E. HANSSON*
Transmission Engineer
Pennsylvania Water & Power Co
Baltimore, Md.

Swedes design 380-kv line to carry 250 Mw 600 miles from northern hydro to southern loads. Prefer use of higher voltages to indefinitely increasing number of 220-kv circuits

IN SWEDEN the bulk of the hydro power is located in the north while the market lies in the central and southern parts. By 1955, estimates call for 16 to 18 billion kwhr or 3,000-3,500 Mw to be transmitted an average distance of 420 miles with a maximum distance of 600 miles. The extreme distance from north to south of the system will be 840 miles. Two steam stations of 300 Mw each, one at Malmö and one at or near Gothenburg, Southern Sweden, are in the plan (Fig 1).

At 220 kv it would require a group of 20 to 22 circuits to handle the load. While not prohibitive, this would hardly be economical and, therefore, the proposed Harsprånget-Hallsberg development is being designed for 350-380 kv probably with level voltage regulation at 380 kv.

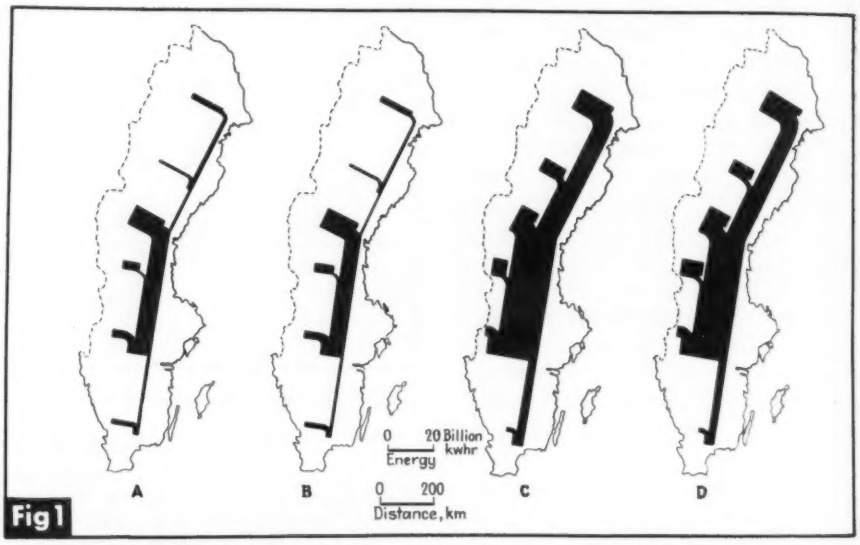


Fig 1

FUTURE ENERGY DISTRIBUTION in Sweden by 1955, and with final development of Harspranget-Hallsberg project

(A) 1955 with uniform load growth
(B) 1955 with load growth in Norrland 50% more rapid than in balance of country
(C) Final development with uniform load growth
(D) Final development with load growth in Norrland 50% more rapid than in balance of country

Present Performance Satisfactory

The 200 kv system has performed satisfactorily in the main. It has been difficult to get satisfactory switching of circuits carrying little or no load. However, the modern ASEA oil breaker will handle this task satisfactorily. In spite of this, future duty of oil breakers will probably be confined to transformer switching, while the lines will be opened by air-blast breakers. While air-blast breakers are not without their troubles, these can easily be corrected by minor changes and improvements. Over-voltage protection and transformers are extremely satisfactory.

Lightning has caused 0.9 flashovers per 60 mi per yr. Half of these have been taken care of by the Petersen coil. The relay scheme has been satisfactory. To reduce switching time to 0.11-013 sec, carrier controlled distance relays have been installed during the last few years. Reclosing operation, with 0.11 sec to open and closing after another 0.3 sec, has been installed on a number of line sections. In many cases, enough generators to prevent overloading of remaining circuits are tripped with the line.

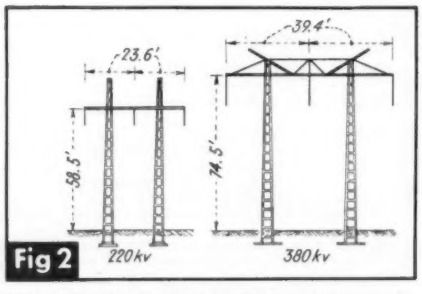


Fig 2

TRANSMISSION TOWERS at left are for 220-kv and at right for 380-kv Harspranget-Midskag-Hallsberg line. Two conductors per phase will be in horizontal plane

Normal load is 150 to 160 Mw per circuit at 230 kv sending and 200 kv receiving voltage. This requires large condenser capacity. A load of 170 Mw has been carried up to 400 km.

The weakness of the system is its low transient stability. Total reactance of 120% is divided thus:

Generators and Synchronous Motors	44 %
Transformers	16 %
Line	60 %
	120 %

The sixth line from Ånge to Västeras, now under construction, is being built with bundle conductors. The estimated gain in stability from reduced impedance is about 30%.

The proposed 380-kv Harsprånget-

* Editorial Note: Mr. Hansson was asked to digest the original Swedish papers because of his familiarity with the art, the language and the country of Sweden.

Hallsberg line is being designed to carry 250 Mw a distance of 570 mi. Conductors will be two ACSR (250 mm² equivalent) per phase, spaced about 18 in. in a horizontal plane. The neutral will be solidly grounded (Fig 2).

While 380 kv will be sufficient for the next 15 years, it will be inadequate for transmission of large blocks of energy from progressively more northern parts of Norrland. Either d-c or 500 kv a-c will be needed. Of these, d-c offers the more promising possibilities but the many problems it presents cannot be solved in time for the Harsprånget project.

Economic Fundamentals

The cost of a transmission project may be said to be comprised of one part proportional to voltage and another part proportional to current. The yearly cost will then be the carrying charges of the two capital costs plus losses. For the line proper, all three elements are proportional to the length and selection of operating voltage and conductor area becomes independent of the line length.

Accepting these premises, the most economical voltage is proportional to the square root of the transmitted power and the cost of transmission can be kept constant if the transmitted power is increased in proportion to the square of the distance.

Thus, if the voltage and cost of 3-phase ungrounded transmission are set at 1.0, the voltages and costs of other systems will be

System	Voltage	Relative Cost
Three-Phase, Grounded	1.12	0.9
Two-Conductor d-c, Ungrounded	1.57	0.82
Two-Conductor d-c, Grounded	2.22	0.69

The Stability Problem

The stability limit of a line decreases with its length and soon reaches a prohibitive minimum. Proper operation requires that lines are not loaded above 78% of their static stability limit. Increasing this limit by increasing the voltage is limited by the status of the art.

Other means to be considered are

1—Multiple conductors per phase. Estimated gain 30 to 40%.

2—Kvar supply along the line. If such supply is of unlimited capacity, the line length can be reduced by one-half from a stability point of view. However, experience has shown that a limited supply increases the stability limit only by an amount equal to 15-40% of the actually available kvar supply.

3—Keeping the reactance of terminal equipment as low as possible.

4—Series capacitors offer tempting

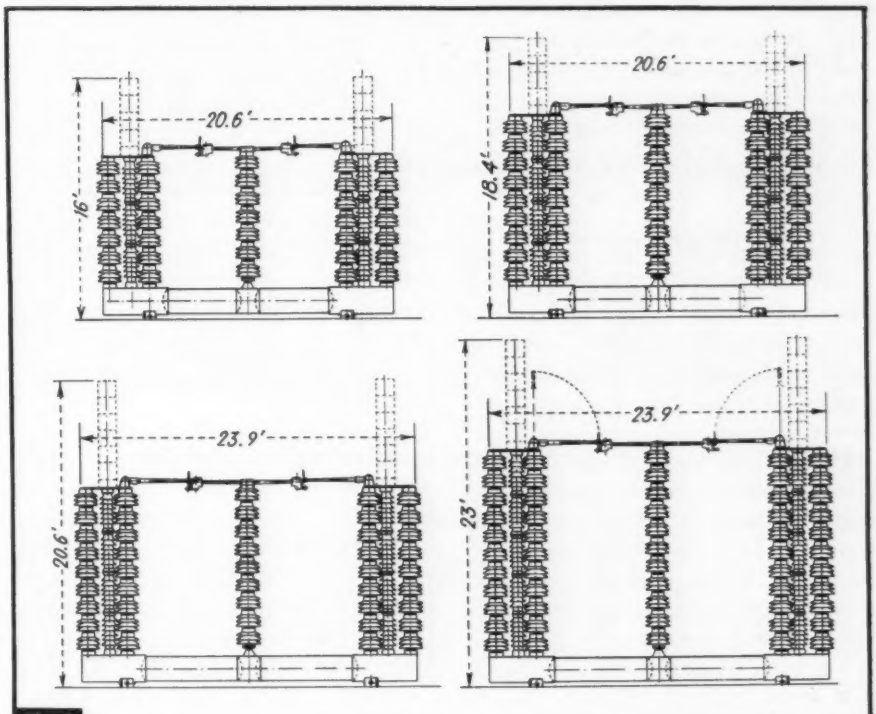


Fig 3

AIR-BLAST BREAKERS for 300 kv, above; for 380 kv, below. Designs on left are for grounded-neutral, on right for isolated phase

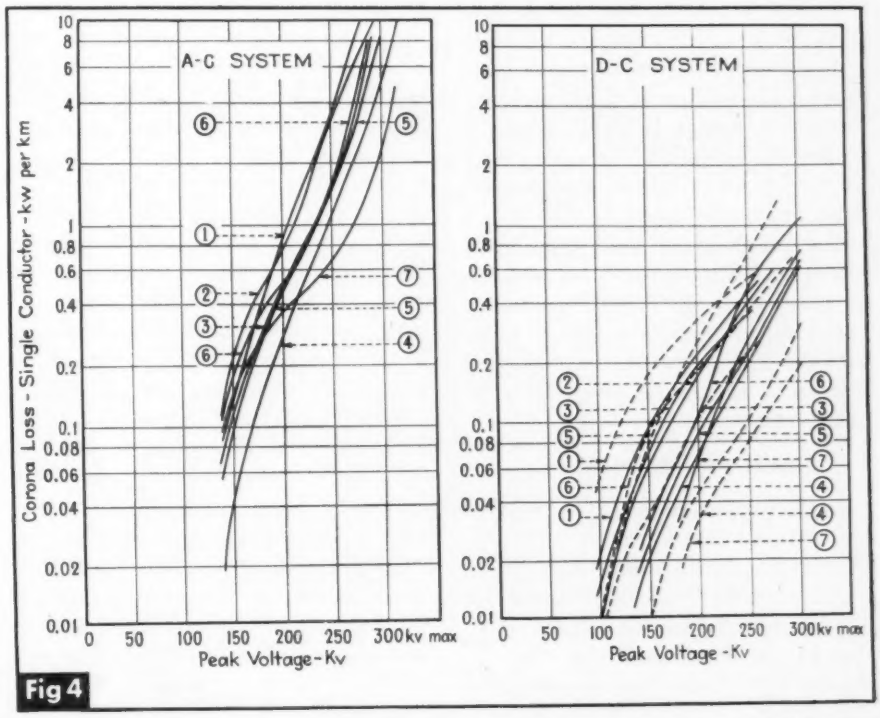


Fig 4

CORONA LOSSES on a single conductor as a function of peak voltage. Curves at left are for a-c, those on right for d-c system; d-c curves for positive and negative polarity are shown

possibilities. The question of reliable protection against over-voltages and the low frequency harmonics appearing in conjunction with synchronous motors remains to be solved.

5—Rapid reclosing and single phase switching.

Transformers

In view of the low reactance required for stability, the question of solidly grounded neutral is given serious consideration. Grounding the neutral permits low insulation between primary and secondary windings, bringing them closer together. The insulation can be graded and surge voltage distribution becomes simpler. Tap changing devices can be placed in the grounded end and even at high voltages, separate regulating transformers can be avoided. It has been suggested that the insulation class be reduced from $5E_n$ to 3.75 or $4E_n$. On this basis, 500-kv transformers can be built for 10% reactance. In view of possible switching surges, the first 380-kv transformers will have full insulation.

3-phase transformers can be built up to 300 kv. The principal difficulty is to obtain sufficient air space between leads and particularly so if the secondary voltage is high. There is no practical solution for a secondary above 70 kv. Where interconnections are to be made at 120 kv or higher, single phase units must be resorted to. They should be as large as possible to give good economy. For interconnection of the 380 kv with the 220-kv systems, serious consideration should be given to autotransformers.

Breakers for Above 200 Kv

In the projected design of breakers for 300 and 380 kv, all but the air-blast types can be eliminated.

Actual tests indicate 8 gaps for 300 kv and 12 gaps for 380 kv. Even the 14 gaps required for 500 kv should not cause any construction difficulties.

Fig 3 shows a simple outline of the proposed breaker. If reclosing is desired, the outside arms only are separated. If the line is to be switched out the central post in addition is rotated 90 degrees. The outlook is for an opening cycle of 60 ms (milliseconds) plus relay time of 20 ms with a possible arcing time of 15 ms, making the interrupting time on the order of 75 to 95 ms maximum, $3\frac{3}{4}$ to $4\frac{3}{4}$ cycles at 50 cps.

As the line is designed for two conductors per phase, corona is considered to be no problem. It is, however, a possibility that the line will be converted to d-c at some future time. For this reason, comparative tests were made on a 1565 ft conductor of 27.7 mm diameter. The diagrams in Fig 4 show the results.

The D-C Problem

A successful solution of the d-c problem requires the ability to handle from 50 to 100 kv per rectifier pot. The conventional construction of a-c mercury rectifiers holds no promise of this. ASEA has for some time experimented with a new design in whic the electrons pass through a long insulating tube in which are mounted a series of electrodes connected to a voltage divider outside the tube. This is the type of rectifier used in the experimental installation at Trollhättan.

At present there are no known means of eliminating arc-backs but they can be held to a given frequency of occurrence for a given load and voltage. The effect of arc-backs can be minimized by providing each pot with a d-c by-pass. The blocking of individual pots has proved very effective at Trollhättan, about 400 arc-backs having been 100% successfully blocked. The commutation is governed to reduce voltage as current increases so the system operates on practically constant current.

The convertors are less subject to arc-back than to arc-through which results in a short circuit on the d-c side. These as well as other d-c disturbances are automatically taken care of by reduction of voltage. If the fault is in an individual pot, this is by-passed; if an actual fault on the line, all the pots are by-passed and power flow interrupted.

D-C Insulation Level

D-c capacitors, being much less expensive than a-c ones, can be used to smooth out surges coming in over the line. Heavy lightning discharges can be taken care of by spark gaps. Capacitors are also required for smoothing the d-c current. The question of oscillations still remains to be investigated.

The rectifiers can produce over-voltages and insulating levels have to be chosen with this in mind. Preliminary calculations indicate that 250 kv d-c to ground should have a basic insulation level of 1025 kv at least on the line end or the same as for a 200 kv a-c system.

Test Operation

The 45 kv d-c installation Trollhättan-Mellerud has transmitted 2,000 kw for 48 hrs without any noticeable disturbances. The tests are now concentrated at Trollhättan with the two rectifiers connected through a lumped impedance in lieu of the line. This combination can be loaded to 3,000 kw. Another combination, double size with 6,500 kw capacity at 90,000 v, is contemplated. As results obtained with the rectifiers of a given size cannot be projected into larger ratings, a still larger project is under discussion. It contemplates four pots of 25 mw at 62.5 kv each, giving a total of 100 Mw at 250 kv. The construction of the rectifiers is under way.

Circuit Problem in Transmission

The ripples or surges transmitted to the a-c system by the rectifiers can easily be taken care of and the necessary capacitors also serve as surge protection. The kvar demand is considerable and amounts to from 40 to 60% of the transmitted power.

The firing impulses must be stepped up to the potential of the individual pots and this presents some difficulty. The simplest means is by insulating transformers but they become very expensive. For this reason, high frequency (50,000 cps) has been suggested. A coreless transformer at this frequency can be made of two separate coils spaced far enough apart to give the required air insulation. This calls for a high frequency generator and means for commutating the high frequency current.

In order to determine the possibility of using earth return for d-c transmission, a series of six test runs have been made. The currents used varied from 20 to 330 amp and the distances from 30 to 600 miles.

While the tests show that the bulk of the current penetrates deeply into the earth, they also show that electrolysis effects and disturbances to railroad signals will be widespread.

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STRONG POINTS

Now, for the first time, you can obtain a splicing tape that matches the qualities of high-voltage Super Coronol cables.

It is the new Super Coronol tape—suitable for use with any rubber-type cable. And though this tape is a simple thing, it's important. Because splices are potential danger points in any cable system. And because Super Coronol tape will last longer than any other.

This tape, like the insulation on Super Coronol cables, is made of butyl-base compound, a synthetic rubber with a custom-built molecule. Remarkable stability makes possible extra long service life, and makes possible a splice as strong electrically as the cable itself.

Super Coronol tape comes in a No. 8 roll, 3/4-inch width, 22-foot length. A new Coronol cement has been developed especially for this tape. For other information and prices, ask for HB 1298, p.1. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

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NEW

type RF OUTDOOR-BRAIDLESS

115KV, 161KV and
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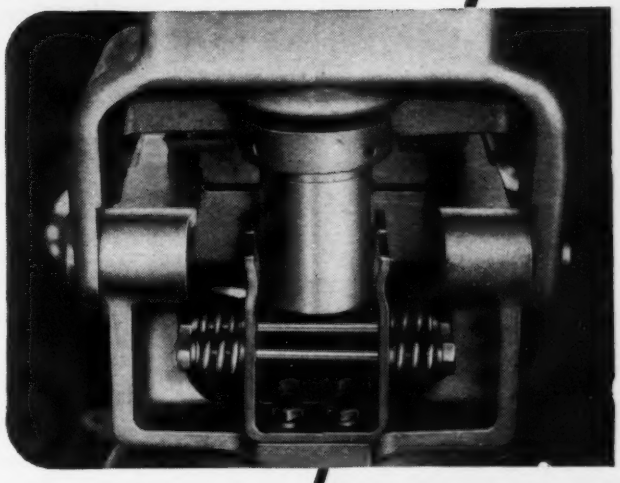
WITH SILVER-TO-SILVER LINE PRESSURE CONTACTS

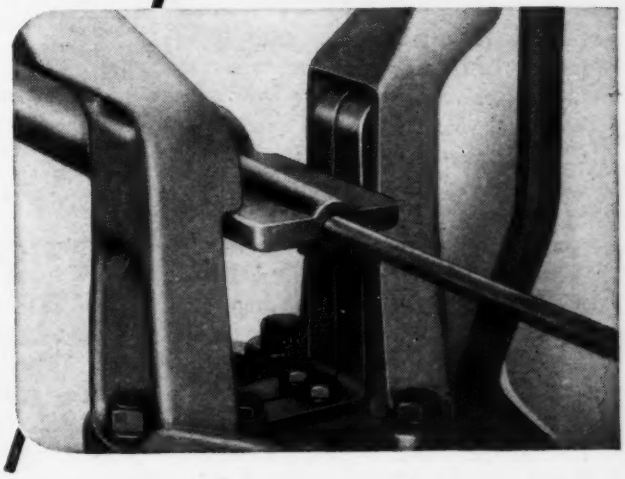
NO CURRENT-CARRYING BRAIDS as silver-to-silver contacts are used for *all* current-carrying duties. At the hinged end the silver surface of the movable blade contacts the silver surface of a U-shaped clip. Adjustable, stainless steel compression springs back the clip. This feature on the RF assures a positive contact at *all* times and eliminates *any* burning of the switch.

NEW OPERATING MECHANISM has no cams, is of simplified construction. Anti-friction bearings are used on all main moving parts . . . "Dual Operation" feature rotates the blade as it enters the stationary contacts. This action firmly forces the blade against the contacts under all weather conditions. The turning motion also locks the blade against the lip of the contact housing . . . Over-travel of the rotating insulator stack is possible without causing any additional rotation of the blade. This feature eliminates any critical adjustment of the operating mechanism . . . and no critical adjustment is necessary after the switch is installed as the three poles of the switch are easy to mount and line up.

CONTROLLED CONTACT PRESSURE eliminates unnecessary scoring and excessive wear on the silver contact surfaces . . . The stationary contact consists of U-shaped copper fingers backed by individual non-current carrying stainless steel springs . . . And remember—silver-to-silver line-pressure contacts are used throughout on the new RF braidless disconnecting switch.

See your nearest G-E sales representative about the new RF disconnect. Write for bulletin GEA-4980. *Apparatus Department, General Electric Company, Schenectady 5, New York.*





GENERAL ELECTRIC

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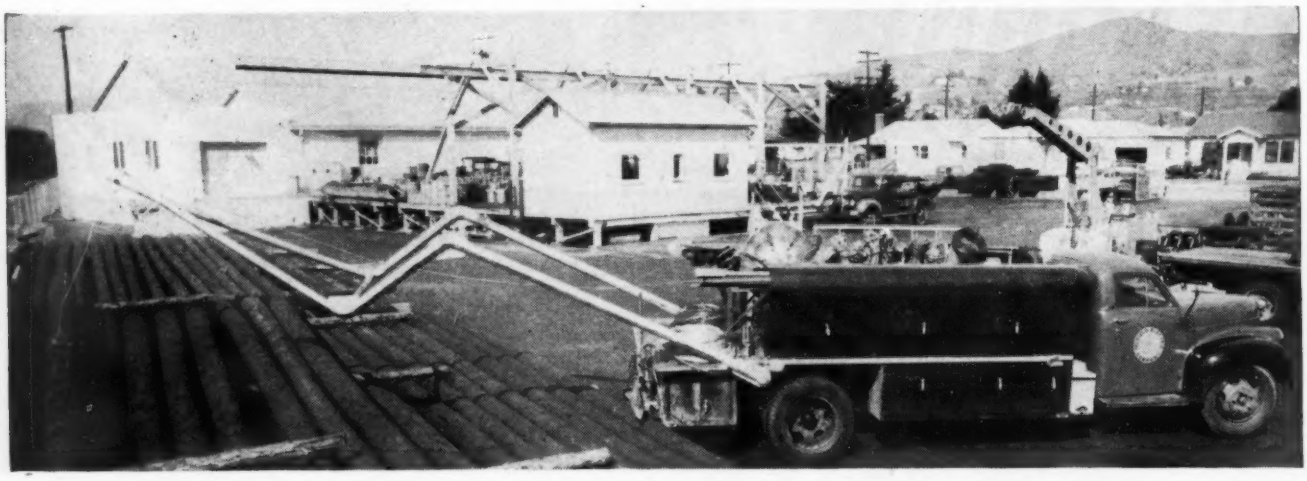
HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



EXTENDED BOOM REACHES over unwanted poles to pick out one required. Poles up to 80 ft in length have been handled in the field

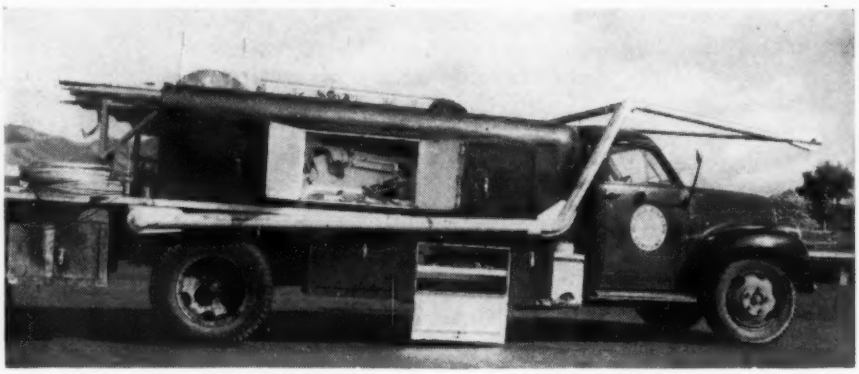
New Boom Truck Saves Time On Construction

SUBSTANTIAL SAVINGS of time and effort in line construction and equipment installation have been realized by the Oilfield Electric Co of Ventura, Calif., using a new type boom truck of their own design. As shown, the boom is a modified A-frame with a dog leg which allows it to rest above the truck cab. Hydraulic rams raise and lower the boom to any position on an arc of nearly 180 deg, where it is locked simply by closing the operating valves. The conventional winch is also operated independently from within the cab.

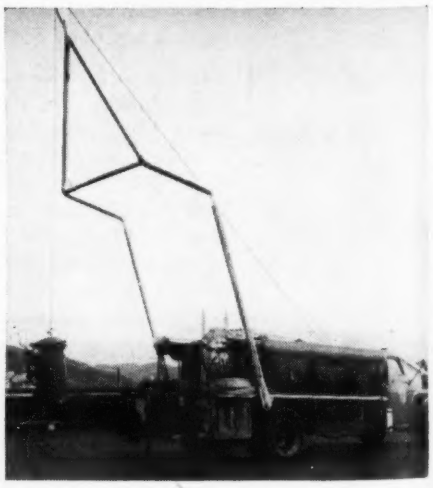
One principal advantage over conventional design is the ease with which the truck may be loaded and unloaded by two men. The 5-ton boom can pick up 3 tons at its lowest position and carry the load directly over the length of the truck body, allowing it to be spotted where desired. In unloading, motors or transformers may be picked up regardless of the position on the truck, and placed up to the length of the boom behind the truck. Another use—the boom can reach over a pile of poles to pick up any particular one. Poles up to 80 ft in length have been handled in the field.

Time to load and unload has been cut to one-third of that required for conventional methods. Installations in the field which formerly used two trucks and two extra men are now made in substantially less time by this one truck and one extra man.

Size of boom can be adapted to large or small trucks. Maximum capacities of 3, 5, and 10 tons will be supplemented by a new model capable of lifting 15 tons from the bed of the truck and carrying it out to a boom angle of 40 deg.



DESIGNED AND BUILT by Oilfield Electric Co, Ventura, Calif., new type boom truck gives great flexibility in handling construction materials. Modified A-frame boom was originally made of 4-in and 3-in oil well pipe; new design uses 8 x 3-in box frame which will rest parallel to truck bed, still allow access to all doors on body and cab



TRUCK IS LOADED by driver and one man in one-third time previously required. Boom can load or unload any part of bed, covers up to 20 ft in a straight line

CUTS CONSUMER OUTAGE TIME...REDUCES TROUBLEMAN TRIPS

The new FR-1 Relayed Automatic Recloser is a distinctive G-E development.

Its exclusive dual-slope time-delay curve, negligible variations of timing mechanism, and freedom from effects of ambient temperatures, make it functionally superior for modern overcurrent protection.

More Reliable Co-ordination

Now, time-current characteristics stay put—remain accurate regardless of season.

The new FR-1 recloser employs a mechanical-escapement timer that is unaffected by changes in ambient temperature. It uses a relay to control, more accurately, the opening of the main interrupter.

Together, these features give a precision of time-current characteristics never before achieved. Co-ordination remains reliable, the year 'round; false operations are eliminated; there are fewer outages, and fewer service trips.

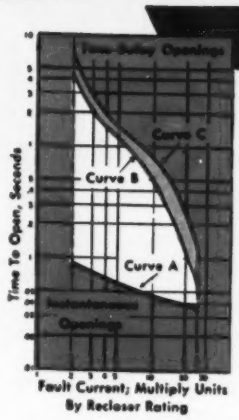
Wider Range Co-ordination

Now, co-ordination can include sectionalizing, branch-line, and transformer external or internal fuses—individually or all in series, with each recloser.

With the conventional operation—see below—it can be reliably co-ordinated with many different fuse ratings. This is because of the recloser's dual-slope time-delay curve and the year-round accuracy of its overall characteristics.

With the extended-range co-ordination operation—see below—it introduces an entirely new concept of recloser-fuse co-ordination. Here, isolation of persistent faults is accomplished entirely by co-ordination of fuses—and an even greater number of fuse ratings can be used in series with each recloser.

HERE IS THE CO-ORDINATION STORY



WITH CONVENTIONAL OPERATION—2 instantaneous plus 2 time-delay openings—a combination which has proved most efficient for minimizing the number and duration of system outages.

1 & 2—Two instantaneous openings.

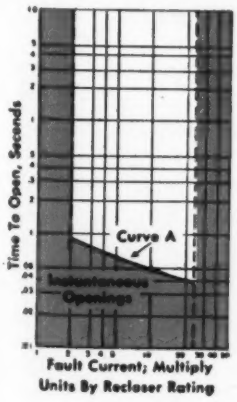
The 1st and 2nd openings are fast, with 1-second to reclose after each. Recloser will *always* trip at or below curve "A" of the chart at left, clearing all non-persistent faults with only a momentary outage, and without even partially melting fuse links coordinated with recloser.

3 & 4—Two time-delay openings.

The 3rd and 4th openings are slow, with 1-second to reclose after the 3rd opening and lock-open after the 4th. Recloser will *always* open within the upper band (between curves "B" and "C") of the chart at left, *regardless of ambient temperature*. The wide area, between Curve "A" and Curve "B" is available for reliable co-ordination of load-side fuses, permitting a choice of fuse ratings that will limit persistent faults to a minimum portion of the circuit.

5—Lock-open

Persistent faults between reclosers or between recloser and nearest load-side fuse will cause the recloser to lock open, and remain open until manually reclosed. The lock-open operation does not interfere with source-side protection because the area above Curve "C" permits reliable co-ordination with source-side fuse or circuit-breaker.



WITH EXTENDED-RANGE CO-ORDINATION OPERATION—2 instantaneous openings plus unlimited time-delay until automatic resetting—a combination extending series co-ordination with fuses, which minimizes the extent of consumer outage.

1 & 2—Two instantaneous openings.

The 1st and 2nd openings are fast, with 1-second to reclose after each. Recloser will *always* trip at or below Curve "A" of the chart at left, clearing all non-persistent faults with only a momentary outage, and without even partially melting fuse links co-ordinated with recloser.

3—Lock-closed

After the two instantaneous openings, the recloser locks closed. This introduces, in effect, an unlimited time-delay (until automatic resetting)—with persistent faults isolated entirely by co-ordinated fuses.

As shown in the chart at left, the area for co-ordination of recloser with both load-side and source-side fuses extends upward from Curve "A" *with no upper limit*, since there is no time-delay tripping characteristic. This function permits a maximum number of fuses to be co-ordinated in series with each recloser, thus increasing the number of available sectionalizing points.

4—Automatic reset

Immediately after a fuse has isolated the persistent fault the recloser automatically resets. Service is restored and maintained everywhere except beyond the blown fuse.

GENERAL ELECTRIC

406-23

Three-Winding Transformers For Feeder Regulators

T. L. RUNDLETT
Transformer Engineer
Westinghouse Electric Corp
Sharon, Pa.

AN INGENIOUS METHOD of constructing 3-winding transformers for step-type feeder-voltage regulators makes it possible to provide power for the tap-changer motor without interference with the potential supplied to the voltage regulating relay. Electrically, it would be easy to use two separate transformers for the power supply to the motor and relay without voltage variations caused by the motor affecting the potential for the relay. But mechanically it would take up too much room or would be inaccessible for maintenance.

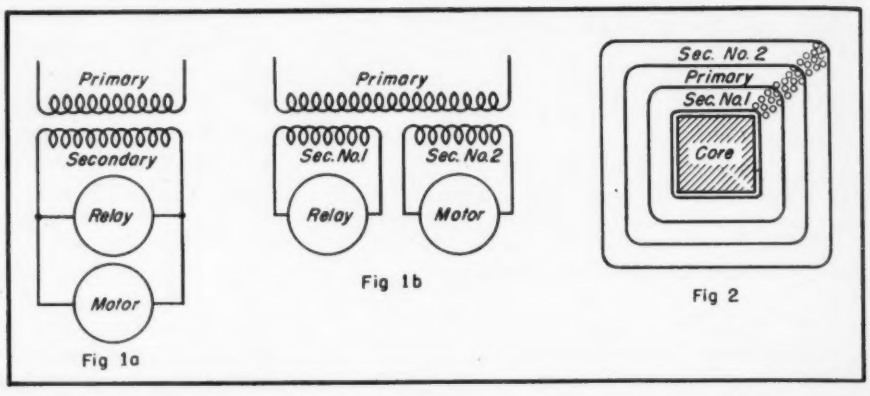
Connecting both loads to a single secondary as shown in Fig 1a or providing two secondary windings for the two loads like those of Fig 1b is not sufficient. In a single transformer or in the usual 3-winding transformer, the natural load variations in the power winding affect the relay potential circuit so that proper operation of the regulator becomes impossible.

Arrangement Method

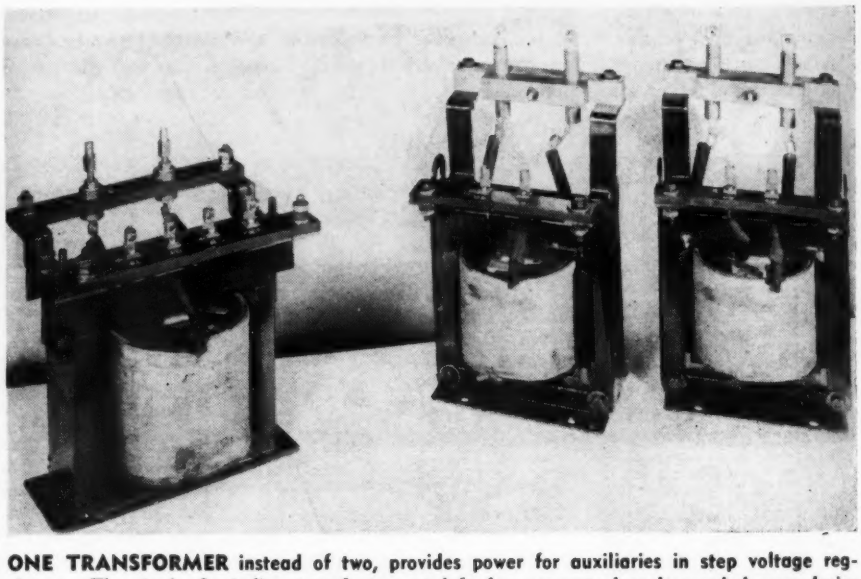
A method of arranging the secondary windings in the transformer reduces the coupling between the two secondary windings so that sudden application or removal of starting current on one winding causes a variation of less than 0.2% in the other.

The arrangement is simple as shown in Fig 2. Both of the secondary windings must be inductively coupled very closely with the primary winding but there must be very loose coupling between the secondary windings themselves. By winding the secondary for the relay potential next to the central core leg on a single-coil type, shell-form core with the primary over this and the motor-power winding on the outside, proper coupling proportions can be established. Routine tests on hundreds of these units prove the results to be as anticipated.

Combining these two auxiliary transformers into one results in considerable improvement in the design of a step-type feeder-voltage regulator for utility service.



STARTING CURRENT from the tap-changing motor interferes with the voltage regulating relay of step-type feeder regulators when both are supplied from the same transformer as in Fig 1a. Similar difficulties result when three-winding transformers like Fig 1b are used. Difficulties are avoided when both secondaries of a 3-winding transformer are closely coupled to the primary as in Fig 2. Loads in one secondary have little effect on voltages in the other because coupling between the two secondaries is very loose



ONE TRANSFORMER instead of two, provides power for auxiliaries in step voltage regulators. The single, 3-winding transformer, at left, has separate loosely-coupled secondaries

Electric Snow Melting For Sidewalks

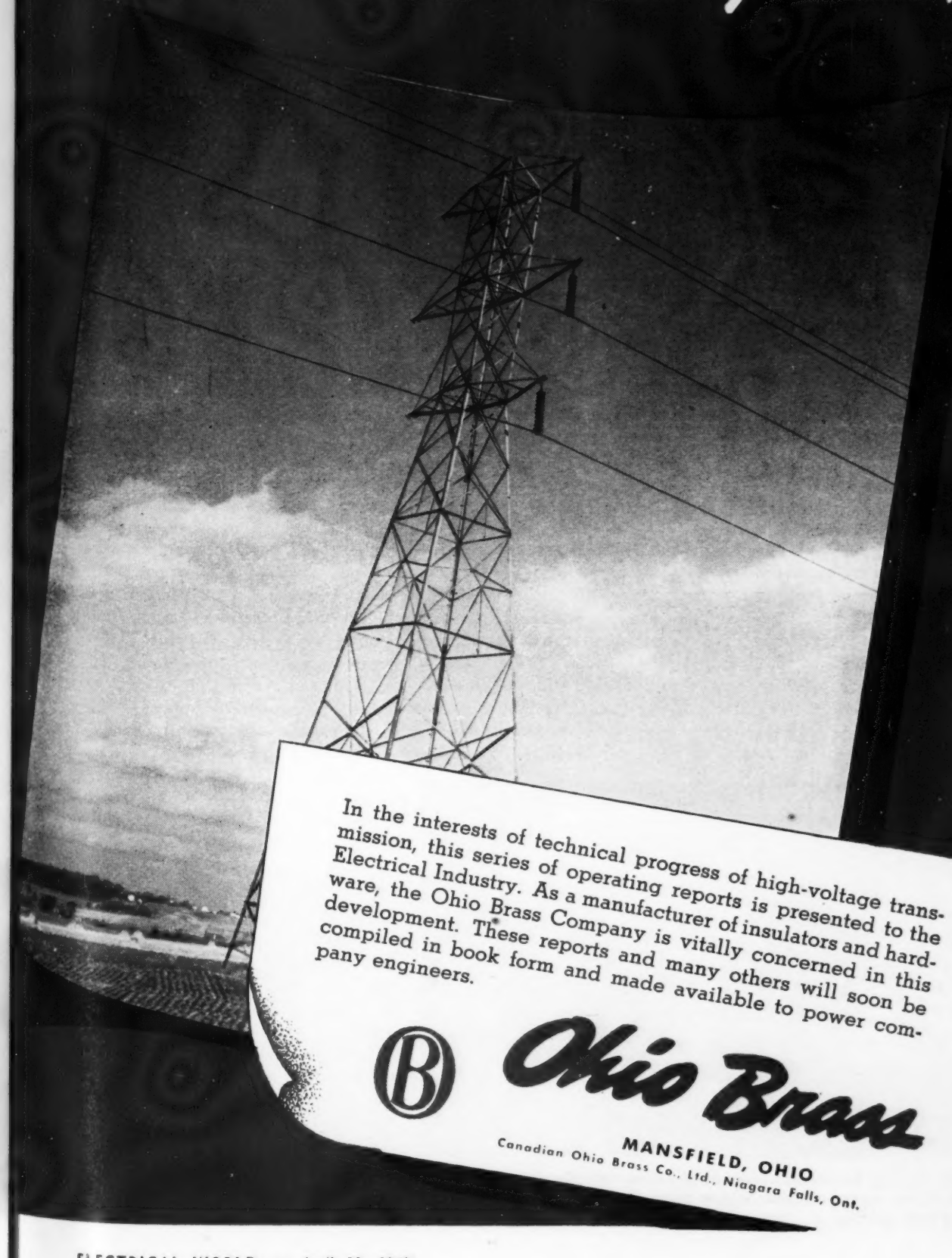
MARIO F. MUZZILLO
M. F. Muzzillo Engineering Co
New York, N. Y.

IN CONJUNCTION with the alteration of Rockland Light & Power Co's building at Nyack, N. Y., an electric snow-melting system was installed for the sidewalks. At the request of F. L. Lovett, vice president of the company and George M. Schofield, architect, it was designed for one sidewalk 120 ft long on Broadway and another 80 ft long on the Main St side.

The installation consists of a lead-covered resistance cable in galvanized steel conduit embedded in concrete. A steel-wire fabric was spot-welded to the top of the conduit for the purpose of facilitating the conduction of heat in the slab. The lead-sheathed heating cable, manufactured by General Electric Co is a No. 19 nickel-chromium alloy, with asbestos and varnished cambric insulation. Output for each length of 120 ft at 230 v is 840 w. Total connected lead is 54 kw at 230 v, 60 cycles, sufficient to melt a snow fall of one inch per hour at an air temperature of 26 F.

When the system is in operation a thermostatically controlled magnetic

132-KV line of Ohio Public Service Co.
50 to One Per Year!

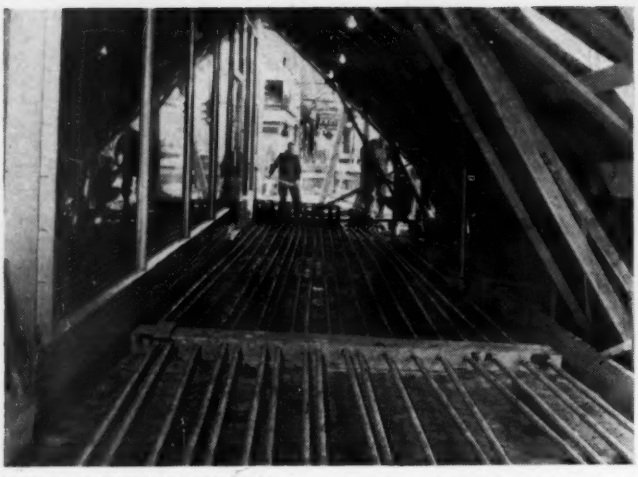


In the interests of technical progress of high-voltage transmission, this series of operating reports is presented to the Electrical Industry. As a manufacturer of insulators and hardware, the Ohio Brass Company is vitally concerned in this development. These reports and many others will soon be compiled in book form and made available to power company engineers.

Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.



SNOW MELTING SYSTEM for sidewalk. (Left) Installation of conduit containing cable prior to embedding in concrete. Lean-to covering was erected over sidewalk for weather protection during construction. (Right) Sidewalk shortly after snow fall. Section of circuit at front center had not been energized in order to provide a good comparison of the system's melting operation

contactor maintains the sidewalk temperature at slightly above 32 F.

During snowstorms the sidewalk has been kept entirely free from snow and ice by simply keeping the circuit energized for a few hours before expected snow fall.

Power for this installation is supplied from the existing summer air-conditioning panelboard, thus making unnecessary additional power facilities. For a similar reason this method is preferable to the hot-water or steam systems since either of these installations would place an additional demand on the boiler during the season of its greatest load. The electrical system also has the advantage over the others of ease in maintenance and repair.

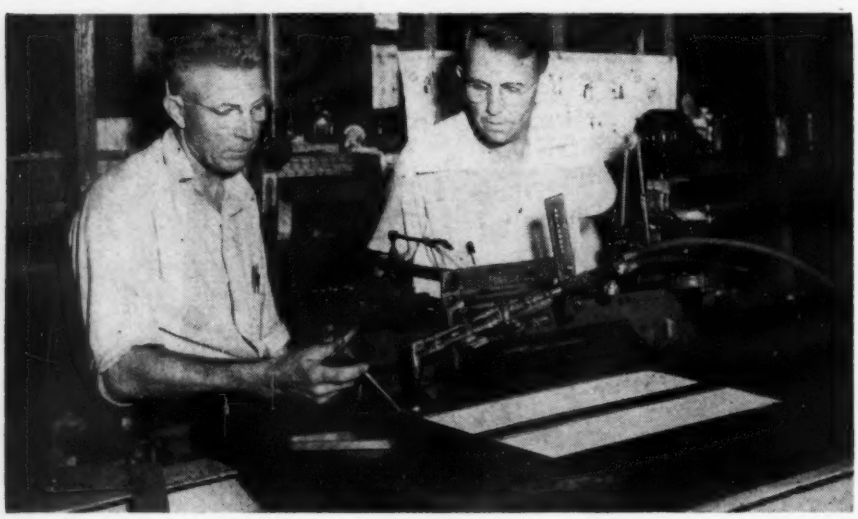
Installation cost of the electrical system was found to be comparable to that of the hot water or steam system.

• • •

Switchboard Panels Made Locally

FACED WITH THE problem of fabricating metal switchboard panels to meet the demand and keep pace with the large construction program, Florida Power Corp, St. Petersburg, Fla. found a solution in a unique method. Devised by W. F. Craig, division superintendent, and Lewis Fletcher, electrician, the method involved the use of a small bench lathe with the tool head removed and an acetylene cutting torch mounted on the tool feed arm.

Considerable experimenting was necessary before proper torch travel speed was obtained. Too slow a speed resulted in a wide cut, possible warping of panels, and unnecessary destruction of a wide area of the finish. Too fast a speed resulted in the cut not being completed and the need for additional work to complete the cut. A speed of 7 in. per min and use of 8 lb of acetylene and 35 lb of oxygen were found to give a very clean cut with very little bead. This cut required a minimum of dressing down. It was then sprayed with cooling water to give best results.



TORCH RIG—W. F. Craig, division superintendent of Florida Power Corp, (left) and Lewis Fletcher, electrician, are shown with their expense-saving device for cutting switchboard panels by using a torch mounted on a lathe

A "Micro" L2, style E cutting tip was used. The cutting torch was mounted on the carriage of a 6-in. swing, 24-in. bed lathe. The cutting speed was varied by means of a multiple pulley V-belt drive.

To start the cut, a $\frac{1}{8}$-in. hole was drilled in each corner of the opening. Templates were made for all standard instruments and relays to be mounted on the panels. These templates helped to reduce the layout time to a minimum.

Increase in efficiency in the use of the torch and in cutting of the panels was substantial when compared with the hacksaw method. The average opening required 102 min with the use of a hacksaw, while with the cutting torch the time required was only 20 min, including the setting up time.

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Time Announcements By Radio Station WWV

Adapted from "Technical Radio Broadcast Services, Radio Station WWV", Letter Circular LC-886, January 30, 1948, by National Bureau of Standards, Central Radio Propagation Laboratory, Washington 25, D. C.

IN TIME ANNOUNCEMENTS, audio tone modulation frequencies (Table I) are interrupted at precisely 1 min before each hour and before each 5-min period. They are resumed precisely on the hour and each 5 min thereafter.

Beginning of the periods, when the audio frequencies are resumed, are in agreement with the basic time service of the U. S. Naval Observatory. They mark accurately the hour and successive 5-min periods.

Eastern Standard Time is announced in telegraphic code each 5 min. This provides a quick reference to correct time where a timepiece may be in error by a few minutes. The zero- to 24-hr system is used starting with 0000 (4 zeros) at midnight. First two figures give the hour and last two figures give the number of minutes past the hour when the tone returns. For example, at 1:55 pm or 1355 EST, four figures (1, 3, 5, and 5) are broadcast in code (International Morse, see Table II).

The time announcement refers to the end of an announcement interval, that is, when the audio frequencies are resumed. At the hour and half-hour the telegraph code is followed by the station announcement in voice.

The 440 cps is the standard musical pitch A above middle C.

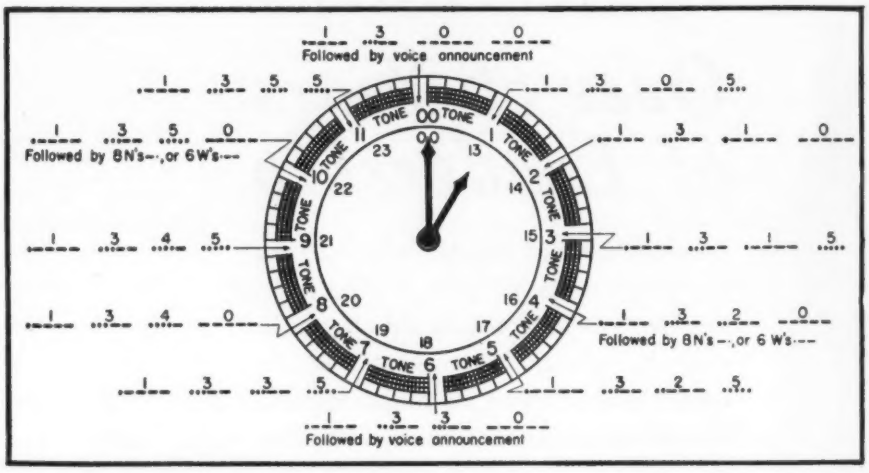

ILLUSTRATION FOR TIME ANNOUNCEMENT is the hour 1 to 2 pm, or 1300 to 1400 in 24-hr time, Eastern Standard Time

Table I—Broadcast Frequencies
(Continuously, night and day)

Mega-cycles	Power, kw	Modulation, cps
2.5	0.7	1 and 440
5	8.0	1 and 440
10	9.0	1, 440 and 4,000
15	9.0	1, 440 and 4,000
20	8.5*	1, 440 and 4,000
25	0.1	1, 440 and 4,000
30	0.1	1 and 440
35	0.1	1

* 0.1 kw for first four work days after first Sunday of each month.

Table II—Numerals in International Morse Code

0	— — — — —	5	• • • • •
1	• — — — —	6	— • • • •
2	• • — — —	7	— — • • •
3	• • • — —	8	— — — • •
4	• • • • —	9	— — — — •

Standard Time Intervals

There is on each carrier frequency a pulse of 0.005-sec duration which occurs at intervals of precisely 1 sec. The pulse consists of 5 cycles, each of 0.001-sec duration, and is heard as a faint tick when listening to the broadcast; it provides a useful standard time interval for purposes of physical measurements and for quick and accurate measurement or calibration of timing devices or very low frequency oscillators. It may be used as an accurate time signal. On the 59th second of every minute the pulse is omitted. The 1-min, 4-min, and 5-min intervals, synchronized with the seconds pulses, are marked by the beginning or ending of the periods when the audio frequencies are off.

A time interval of 1 sec marked by the pulse is accurate, as transmitted, to one microsecond (0.000-001 sec). A 1-min or longer interval is accurate to a part in 50,000,000.

The 1-min interval without tone modulation is provided in order to give time and station announcements and to afford an interval for the checking of radio-frequency measurements free from the presence of the audio frequencies.

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good man

TO DO A

good job-

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Overload Calculations For Cable Current Ratings

A simplified method of overload calculation for cables and an outline for present rough constants necessary

E. W. DAVIS
Chief Electrical Engineer
Simplex Wire & Cable Co
Cambridge, Mass.

Forms of fundamental cable heating curve equation:

$$T = T_c + (T_m - T_c)(1 - e^{-t/K}) \quad (1)$$

$$T_s = T_a + (T_c - T_a)\frac{I_s^2}{I_c^2} \quad (2)$$

Evaluating for T_c and T_m, obtain:

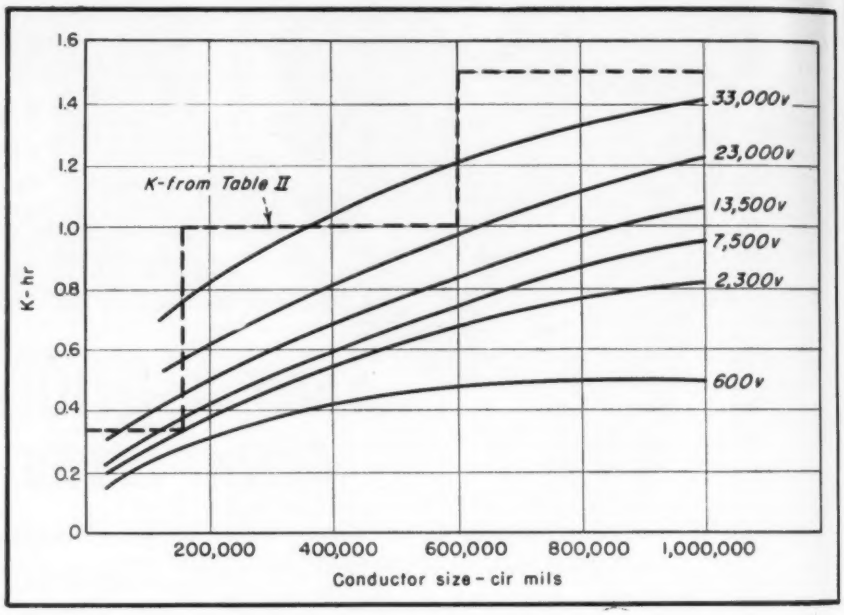
$$\frac{I_m}{I_c} = \sqrt{\frac{1 - \left(\frac{I_o}{I_c}\right)^2 e^{-t/K}}{1 - e^{-t/K}}} \quad (3)$$

where T = conductor temperature at any time t
T_c = initial conductor temperature at time $t = 0$
T_m = maximum temperature conductor will reach if current is held constant for a long time and for I_m
K = constant of cable (time in hours for the cable to reach 63% of its total temperature rise)
T_s = maximum conductor temperature for current I_s
T_a = ambient temperature
T_c = maximum rated conductor temperature for I_c from tables (IPCEA)
I_c = current carrying capacity from tables (100% load factor) (IPCEA)
I_m = permissible overload current if continued for a long time

Table I gives a tabulation of Equation (3) in terms of t/K for selected values of the ratios I_m/I_c and I_o/I_c. If it is necessary to operate at higher than rated temperature for a short time, determine from Equation (2) a new value for I_c corresponding to the new allowed temperature and then continue the calculation as before.

TABLE I—Values of t/K

Overload Percent (I_m/I_c)	Previous Load, Percent (I_o/I_c)				
	0	20	40	60	80
125	1.03	1.00	0.92	0.76	0.50
150	0.59	0.57	0.51	0.41	0.25
175	0.40	0.38	0.34	0.27	0.16
200	0.29	0.28	0.25	0.19	0.11



VALUES of K for single-conductor paper and lead cables in air, volts cable rating

Table II gives approximate values for K for various cables and installation conditions. It is applicable to all types of installations. But it is only an approximation for general guidance.

Use of the tables is shown in the following examples:

Example 1—Given the percent overload I_m/I_c, find the permissible time t. Enter Table I with percent overload and percent previous load I_o/I_c, and find corresponding value of t/K. Take value of K from Table II for the given installation. From these values of t/K and K, calculate t.

Example 2—Given the time t of overload, find the permissible amount of overload I_m/I_c. Use value of K from Table II and the known value of t to calculate t/K. Enter Table I with this value of t/K and the given value of previous percent loading I_o/I_c; find the corresponding percent overload I_m/I_c.

The values of K listed are obtained from current literature and represent fairly the spread of the data. The graph shows the data from Table II for cables in air and also calculated values of K for single conductor paper cable of various working voltages. In calculating this data, the following heating constants were used:

Copper	= 0.048 watts/hr per lb per deg C
Impregnated Paper	= 0.198 watts/hr per lb per deg C
Lead	= 0.016 watts/hr per lb per deg C

Standard values for thermal resistance and emissivity as used in IPCEA tables for current carrying capacity were used.

TABLE II—Values of K in Hours

Cable Sizes	Cable in Air	Cable in Ducts Underground	Cable Buried in the Ground
Small.....	½	1	1¼
Intermediate...	1	2½	3
Large.....	1½	4	6

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Stringing Operation For 6,688-ft Span

RURAL EXTENSION included construction of a 6,688-ft span across canyon from Idaho to Washington on far side of river. Dead-end and guy poles for one conductor can be seen in lower right corner

CONSTRUCTION OF A 2-CONDUCTOR span across Hell's canyon on the Snake River was a matter of no little concern for the Clearwater Valley Light & Power Association, Lewiston, Idaho. The span is 6688 ft horizontally and the catenary length is 7046 ft. (EW, Mar 27, Page 122).

The cables of 7 No. 9 E.H.S. Copperweld had been fabricated in one piece for each catenary and shipped to the job, weighing over 2,000 lb per reel. Two dead-end poles with guys and top assemblies were installed on each side of the canyon after tedious work with rock and dynamite on steep hillsides. But the last and biggest job was the stringing of the conductors.

Preliminary to actual stringing, about one mile of small guy strand had been stretched as follows: (1) from the east river bank, (2) through some "dollies" at the top of the poles on the west rim and (3) from there back down the hillside to the road. The poles on the west rim are located about one-quarter mile above the river.

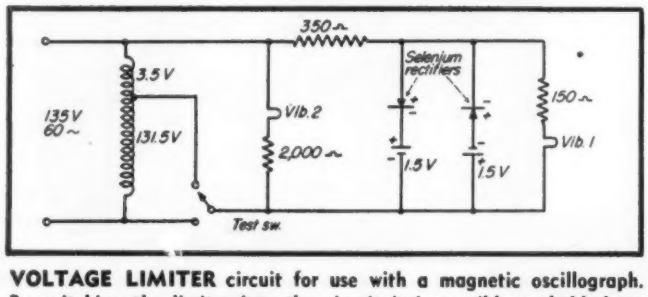
The conductor reels were set up on the east rim and from there the cable was pulled manually to the river's edge. Then it was connected to the guy strand and pulled across the river in the air to the west rim structures, by a tractor connected to the other end of the pulling strand.

Since distances were so great, communication was impossible by ordinary methods. The entire job was supervised from a small radio transmitter strategically located and in constant communication with six portable 2-way sets located along the 7050 ft of conductor. The U. S. Forest Service cooperated in this project; otherwise, without the use of its radio equipment, the time taken would have been extended.

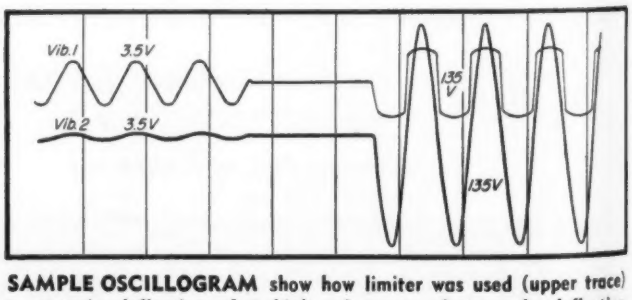
The cable stringing progressed without undue mishap and the job was finished in about three days.

• • •

Voltage Limiter For Magnetic Oscillographs



VOLTAGE LIMITER circuit for use with a magnetic oscillograph. By switching the limiter into the circuit it is possible to hold down the higher voltage deflection so the lower-voltage trace can be sufficiently amplified for accurate reading



SAMPLE OSCILLOGRAM show how limiter was used (upper trace) to restrain deflection of a high voltage so that ample deflection can be obtained for accurate reading of a lower-voltage portion of the same trace. The lower trace was made without the limiter

C. J. TIRK
Engineering Laboratories and Standards
Westinghouse Electric Corp
East Pittsburgh, Pa.

IN THE OPERATION of a magnetic oscillograph there are measurements to be taken of a small voltage which suddenly rises to a large voltage. In most cases we are interested in the small voltage, but the oscillograph has to be set to take care of the larger voltage values.

The result is that small voltage is not readable due to lack of deflection. The sudden jumping of the small voltages makes measurement very difficult. Conversely if the oscillograph is set to get a sufficient deflection on the

CHANCE GK-5 Switches*

7.5 to 287 KV

Long Life, High Pressure Area Contacts wipe clean without abrasion

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All details of the control mechanism of GK-5 switches have been designed to give years of smooth, dependable performance without field maintenance. Oilite bearings are used throughout . . . Switches for 69 KV and above have switch blade counter-balancing mechanism for easy gang operation . . . High pressure contacts are obtained by a simple toggle device.

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● **SILVER CONTACT SURFACES** — lower contact resistance by preventing copper oxidation.

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● **HIGH PRESSURE AFTER CLOSING.** High pressure is applied after switch blade has completely closed. Pressure is released before blade travel starts, minimum contact resistance is obtained without surface abrasion, insuring long contact life.

Diagram and cutaway photo show the contact mechanism of the GK-5. After closing motion is completed, control rod, actuated by a cam, causes toggle links to press against leaf springs which set the high pressure between contact surfaces.

C486

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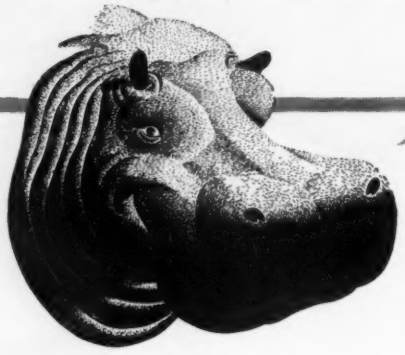
Blocks and Sheaves!



MR. HIPPOPOTAMUS leads a tough life . . . so he has wisely developed a thick, armor-like skin to stand the gaff. And that suggests a pointer about blocks and sheaves. They, too, are bumped, banged, scratched and battered . . . exposed to mud, water and the elements.

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only "American" Blocks and Sheaves have ***armored construction***

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Heavier pins and axles
Tough steel reinforcing straps
Sheaves of hard iron or alloy steel . . . thick flanges, precision shaped grooves
Self-lubricating bushings, bronze bushings, or anti-friction bearings
Oversize forged steel hooks and shackles

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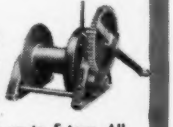
HOISTS • DERRICKS • HANDIWINCH • GENUINE CROSBY CLIPS

B301

Genuine **CROSBY CLIPS**

For fastening wire rope, use genuine CROSBY CLIPS—Made of highest quality drop-forged steel, hot dip galvanized. To make sure you get *genuine* CROSBY CLIPS, look for the famous Red-U-Bolt. All sizes—⅛ to 3 inches. Distributors everywhere.

AMERICAN HANDIWINCH



Gives one man the power of a crew. HANDIWINCH weighs only 95 lbs. Can be carried and set up anywhere; handles lifting, loading and pulling jobs up to 5 tons. All steel construction, cut gears. Ask your distributor.

small voltage, when the large voltage is applied, the deflection is too large and the vibrator is damaged.

If we use a limiter the small voltage can be read; then when the large voltage is applied it is limited and the vibrator is not damaged.

All current will flow through vibrator 1 when the a-c voltage is low. The bias of the rectifiers will not permit the current to go through the rectifiers. The batteries will block low voltage but when the voltage increases above the battery voltage the excess current will flow through the batteries and vibrator 1 will have low voltage applied. The current will be limited as shown in the sample oscillograph.

The schematic circuit diagram shows how the circuit and the switching arrangement are used to obtain the sample oscillogram. The vibrator used was a sensitive type similar to that in a Westinghouse Type PA oscillograph. The cells are 1½ No. 6 dry cells. Selenium rectifiers, single disc $2\frac{3}{16}$ in. diam, with a very low forward resistance are used. Referring to the circuit diagram, it was desired to measure 3.5 v with a reasonable deflection when the voltage suddenly would increase to 135 v. Vibrator 1 has the limiter on and vibrator 2 has no limiter.

The oscillogram shown starts with 3.5 v being applied to both vibrators and then switched to 135 v.

The voltage measured may be increased by the addition of more cells connected in series in each leg of the rectifier, but this voltage should never be increased above the ratings of the rectifiers.

This limiter is now being used in our laboratories. It gives very satisfactory results in circuit breaker testing in measuring accurately arc voltages which are only a small part of the test voltage that appears immediately after arc interruption.

•

Unit Substations Reduce Line Losses At Mill

A 50% REDUCTION in line losses, a saving of 75% in installation costs, and an increase in production have resulted from the installation of two 1000-kva, out-door type, load-center unit substations, at a large Southern textile mill. A third General Electric

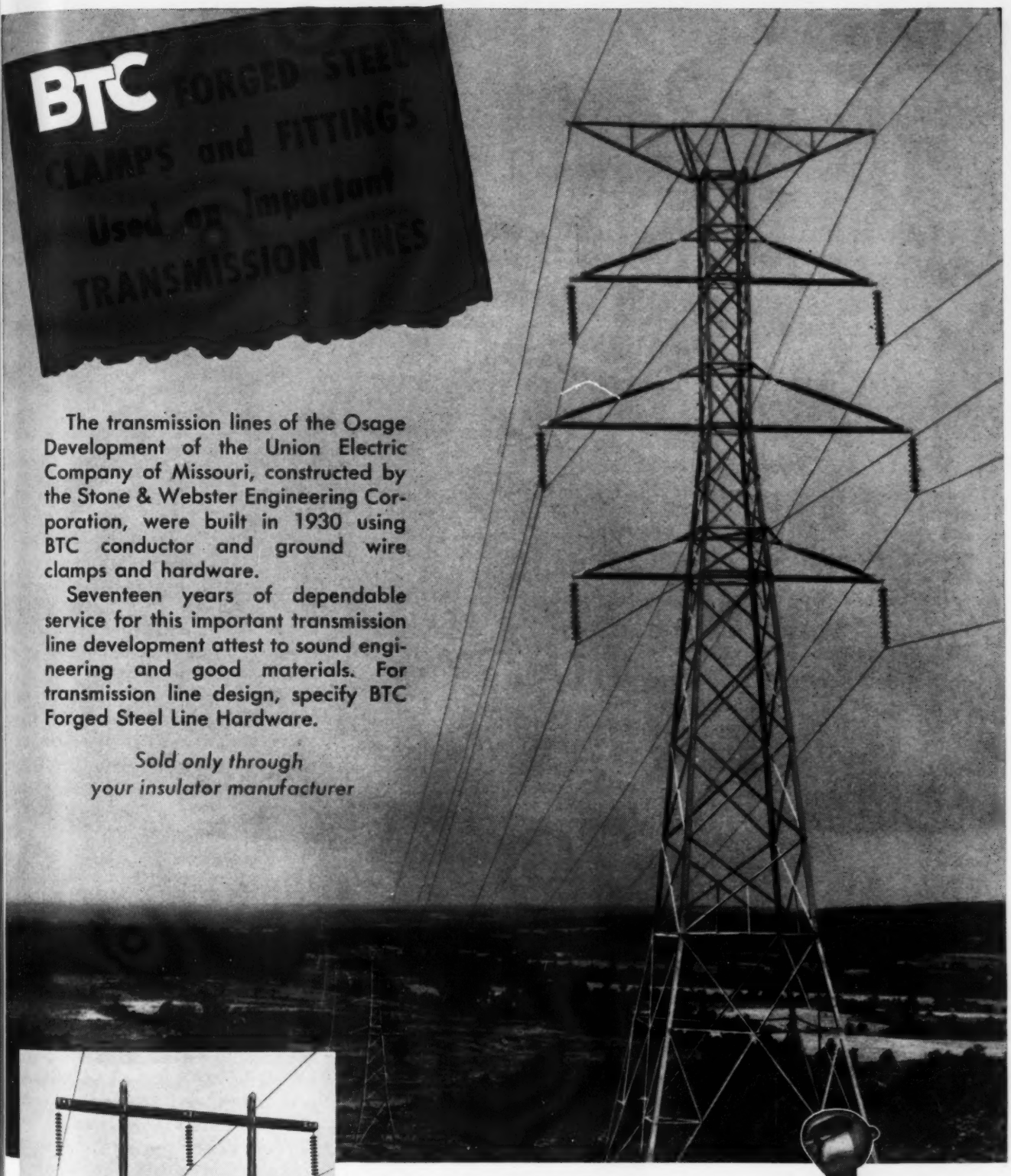
BTC

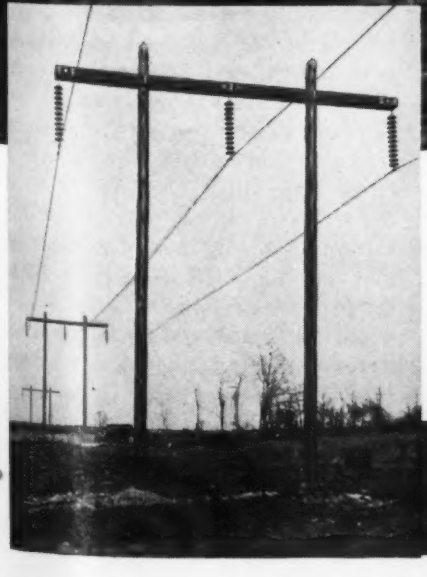
FORGED STEEL
CLAMPS and FITTINGS
Used on Important
TRANSMISSION LINES

The transmission lines of the Osage Development of the Union Electric Company of Missouri, constructed by the Stone & Webster Engineering Corporation, were built in 1930 using BTC conductor and ground wire clamps and hardware.

Seventeen years of dependable service for this important transmission line development attest to sound engineering and good materials. For transmission line design, specify BTC Forged Steel Line Hardware.

Sold only through your insulator manufacturer





Above: The 119.5-mile Osage-Rivermines Line with steel towers and hinged wood cross-arms carrying 250,000 cm. copper conductor, 138 kv., and 7/16" Siemens Martin galvanized steel ground wire.

Left: The Osage-Page Line covers 135.5 miles with wooden "H" frame structures carrying 336,400 cm. A. C. S. R. conductor, 138 kv., and 7/16" S.M. galvanized steel ground wire.

7200 SERIES

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

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AVOID TRANSFORMER EXPLOSIONS or FIRE HAZARDS

MARCUS AIR-COOLED TRANSFORMERS

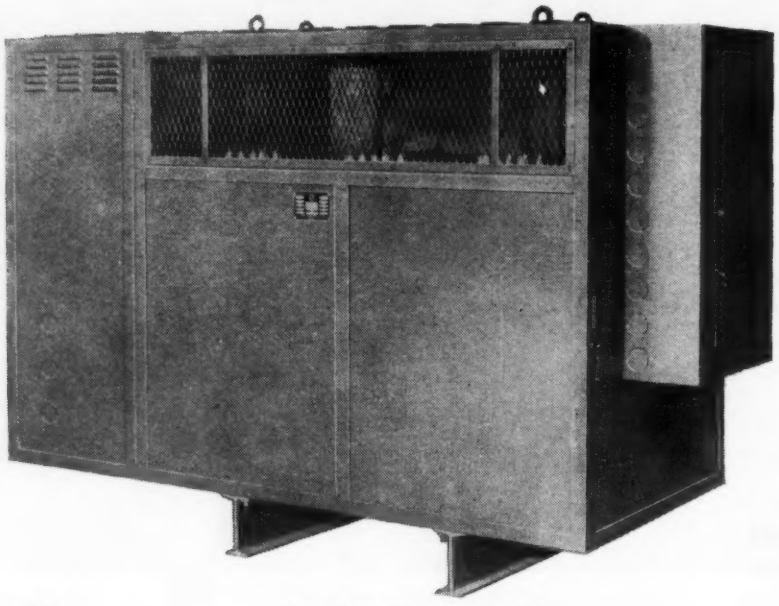
There's no oil to burn or explode—no messy or toxic liquids—no need of a fireproof vault. In addition, Marcus Air-Cooled Transformers are economical—compact—efficient. They require only negligible attention or maintenance. Electrically, you can be assured of cool, continuous operation at rated capacity. Heatproof Class B (glass, mica, asbestos etc.) insulation withstands severest operating conditions.

Marcus Air-Cooled Transformers are available in sizes up to 1000 KVA, single or three phase in voltages up to 13,200.

*IMPORTANT — GOOD DELIVERIES

FIRM PRICES — NO ESCALATOR CLAUSES

Write for more details



300 KVA TRANSFORMER

Primary 4160 volts, 60 cycles, 3 phase; Secondary 480 volts; complete with primary and secondary switches

MTC

PIONEEERS IN THE FIELD OF AIR-COOLED TRANSFORMERS

MARCUS TRANSFORMER CO., INC.

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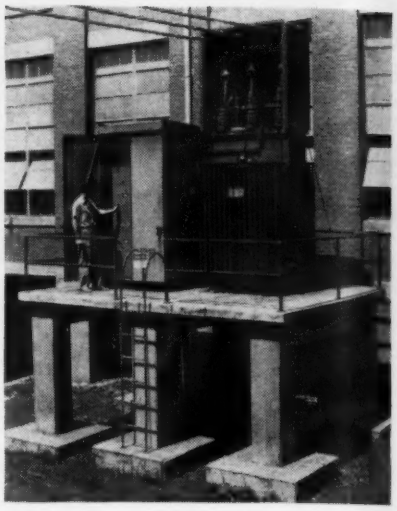

OUTDOOR SUBSTATION, 1000 kva, 11,000/600 kv, is mounted on concrete base as protection from floods

unit of the same rating will be installed.

According to the textile company, these substations have increased production by eliminating shutdowns for repairs and providing the mill with dependable and continuous service.

The electrical engineer of this mill group said that with the old distribution system, it was necessary to replace contacts on oil-circuit breakers, clean the tanks, and renew the oil in them twice a year. All of this work had to be accomplished on an overtime basis on weekends, when the mill was not operating, which resulted in considerable extra expense. The new substations are equipped with drawout-type circuit breakers which can be interchanged readily.

These co-ordinated substations are located in small, out-of-the-way areas near the load. Feeders average from only 200 to 250 ft in length compared with feeders of 800 to 1000 ft required by the old distribution system. Line losses have been reduced as a result, and constant, accurate voltage regulation is obtained.

These substations are located outside a section of the mill built over a creek bed which heavy rains flood almost every Spring. To protect the substation during these flood periods, they are mounted on 13½ x 16 ft reinforced concrete bases raised about 10 ft above the ground. Protection for the top bushings of the substations is provided by a three-sided metal screen. The equipment is totally enclosed and kept locked at all times, thus assuring safety to the personnel.

All power for this mill is pur-

"EVEREADY" FLASHLIGHTS FOR INDUSTRY

ALL FOUR "Eveready" Industrial Flashlights are built to stand up under the day-to-day abuse of rugged industrial jobs. Equipped with silver-plated die-cast reflectors and prefocused lamps, these automatic spotlights deliver a clear, round spot of high intensity light.

FOR EFFICIENCY

in general industrial use, we recommend the Two-Cell Industrial Flashlight No. 1251 . . . or the more powerful Three-Cell model No. 1351. These "Eveready" brand flashlights are sheathed in a durable covering of rubber and chemigum, reinforced with heavy-gauge brass. This covering cushions shock and is resistant to water, oils, greases, gasoline, alcohols, and acids. The molded slide switch is easily taken apart and reassembled by hand. The ring recessed in the bottom cap is handy for carrying or hanging the flashlight.

FOR SAFETY

in explosive atmospheres, we recommend the Two-Cell Permissible Safety Flashlight No. 1259 . . . or the higher-powered Three-Cell model No. 1359. These lights are identical with the industrial flashlights described here, with the exception that they also have a spring-loaded contact within the reflector assembly . . . so that if the lamp should break in a dangerous atmosphere, this contact opens the circuit before the filament can ignite the explosive mixture. There is also a spare lamp carried in the bottom cap for quick changing on the job. Both "Eveready" Safety Flashlights are approved by the Bureau of Mines and the Underwriters' Laboratories for use in explosive atmospheres of: natural gas, lacquer solvents, acetone, alcohols, naphtha, gasoline, petroleum, propane, butane, benzine, and benzol.

The term "Eveready" is a registered trade-mark of

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UCC

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for being discriminating!
When buyers start demanding Quality Lighting Equipment — We're happy!
When they want quality Lighting Equipment at Economy Prices — we bubble over with joy! — Because then our business really booms!
Here is some of the BEST LIGHTING EQUIPMENT money can buy.
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Island Light with attached Trough and Flood Lamps

For the complete line of SILV-A-KING Flood-lighting Units, and all other Incandescent Reflectors, send for free Catalog #50.

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INCORPORATED
Subsidiary of BRIDGEPORT PRESSED STEEL CORPORATION
FAIRFIELD & STATE, BRIDGEPORT 5, CONN.

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	Minneapolis, Minn.	

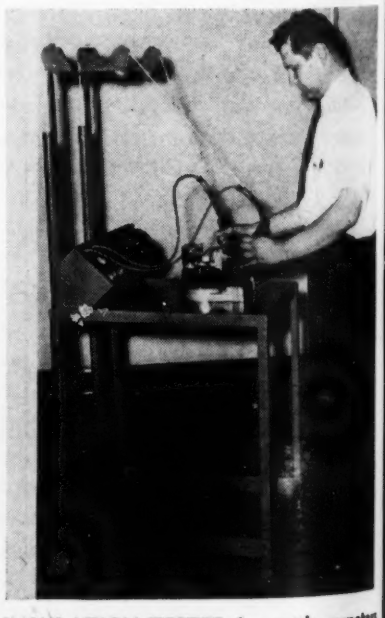
SILV-A-KING LIGHTING EQUIPMENT

chased and is delivered to the two new outdoor substations and a conventional-type indoor substation, having three 667-kva, single-phase, Pyranol-filled transformers, at 11,000 v, 60 cycles, 3-phase. From the new substations, each one of which has five feeder circuits, and the indoor substation, which has eight feeder circuits, the power is stepped down to 600 v for distribution inside the mill. The 3-shielded, single-conductor cables, rated 15 kv, leading to each unit substation, are suspended on messengers and feed the transformer through conventional cover bushings.

•

Insulation Tester For Watthour Meters

INSULATION TESTS on watthour meters are made at 1,500 v in the meter laboratory of Metropolitan Edison Co using the arrangement shown. It consists of a conventional GE high-voltage test set mounted for convenience on a grounded metal table with castors for mobility. The tester is supplied at 110-v and provides voltages up to 3,000 v. Test leads are counter weighted and equipped with safety test handles including retracting, trigger-operated electrodes. The retracting feature of the electrodes reduces the possibility of short circuits during test, thus preventing possible flashes. The 110-v extension cord to the tester has three conductors.



INSULATION TESTER for watthour meters mounted on grounded metal table has retractable, trigger-operated electrodes

Wagner

Can Supply the RIGHT Transformer for Every Rural-Line Application

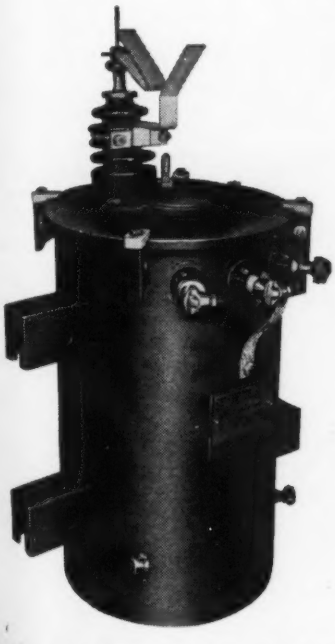
Wagner Rural-Line Transformers are nationally known for their high standard of quality and performance. They are establishing enviable service records in the field, upholding the Wagner reputation for dependability earned during our half-century of designing and building distribution and power transformers.

Wagner offers a completely diversified line of transformers designed to meet the requirements of rural-line distribution service. Nation-wide service facilities are available, and 29 branches in principal cities are ready to help you with your transformer problems.

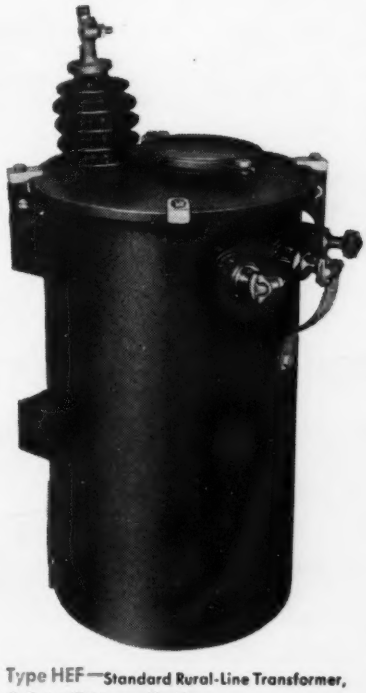
Wagner makes a complete line of Rural Transformers

Get performance plus protection by selecting the type that meets your requirements from Wagner's complete line. For full information write for Bulletin TU-1C. Your copy will be sent immediately.

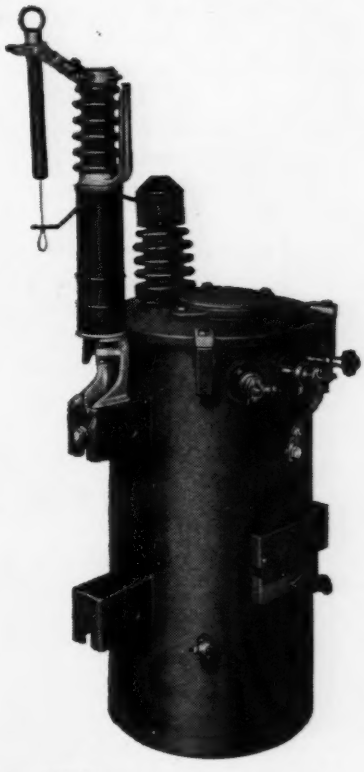
Wagner Electric Corporation
6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.



Type HEF-5—Double "bird-proof" gap provides surge protection; internal fuse forms a protective link between the transformer and the high-voltage line. When the double gap and internal fuse are combined no other surge protection or transformer fuses are required.



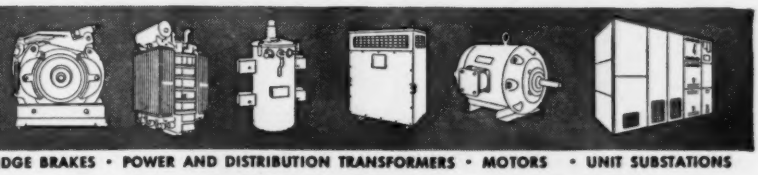
Type HEF—Standard Rural-Line Transformer, E. E. I.-NEMA specifications.



Type HEF-7—Protected Rural-Line Transformer. Equipped with expulsion-type lightning arrester and primary fuse.

Consult Wagner Engineers on All Transformer Problems

Wagner Electric Corporation
EST. 1891



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL AND AUTOMOTIVE PRODUCTS

148-7

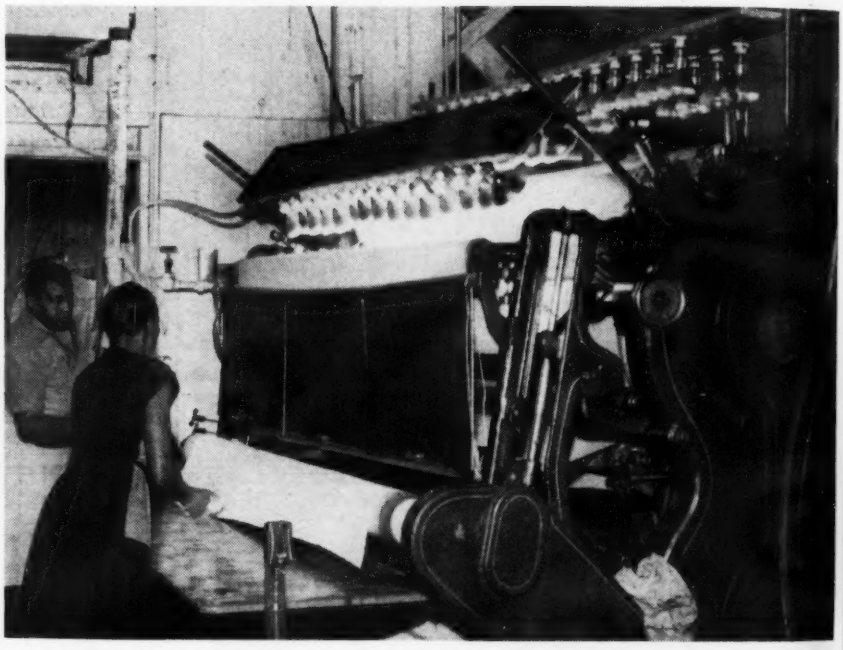
LOAD BUILDING

Infrared Saves Laundry Investment

PARKER'S SNO-WHITE LAUNDRY in Macon, Ga, had to have more flat work ironing capacity. One way to get it would have been to install another ironer at a cost of $7,500 to $10,000 for the machine, plus more cost for motors, control and wiring, and also for an enlargement of the building. But no serious thought was given to that idea; the problem could be solved more simply and cheaply.

Robert F. Levin, manager and co-owner of the laundry, working with Georgia Power Co engineers and a local electrician, designed and had installed a couple of banks of heat lamps on the overloaded ironer, as appears in the accompanying picture. Each bank contains 30 250-w lamps and is adjustable in distance from the work.

The ironer is a 100-in. machine with four speeds. With the infrared heat it can be operated at higher speeds with proportionate increases in output. The overall increase worked out to about 20 percent. The machine operates 24 days per month, one bank of lamps 9 hr per day and both for 2 hr. Estimated increase in energy use by the laundry is 26,280 kwhr per year.



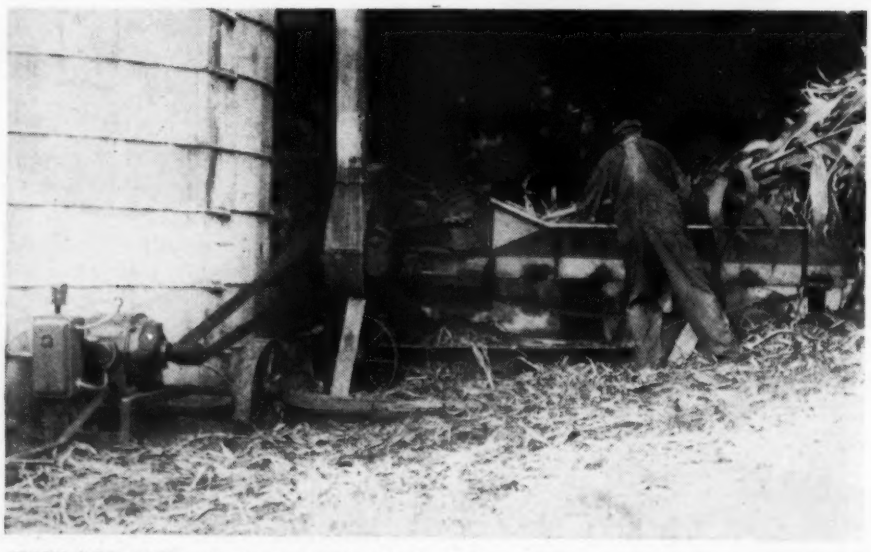
INFRARED LAMPS on ironer avoided installation of another machine

• • •

Tests of Ensilage Cutters Driven by 7½-Hp Motor

J. W. HALL and A. W. COOK
Agricultural Engineers
Appalachian Electric Power Co
Roanoke, Va.

DURING THE PAST few years there has been a lot of interest in cutting ensilage with an electric motor, but very little local information available. Therefore, we decided to run tests on different makes of ensilage cutters, using 7½-hp motors and varying the speed of the cutters to get the best results. Different size cutters were also tested to establish some basic information. After several checks were made, it was found that the rate of ensilage cutting with a 7½-hp motor was about 7 to 8 tons per hour, regardless of the size of the cutter. But



ENSILAGE CUT and elevated with 7½ hp motor. Many types of cutters were tested

"Pittsburgh's" Store Modernization Caravan

A store-lighting show

IN TWELVE ACTS

WHEN the curtains part on this unique presentation by "Pittsburgh," you'll witness one of the best merchandising shows in many a year. For the Pittsburgh Store Modernization Caravan—comprising twelve scale-models of distinctive store designs . . . presents the latest advances in store front and interior designs; the most modern lighting techniques. Each model is complete in every detail. Actual store conditions are simulated in miniature. Exteriors, windows, interiors, lighting are faithfully and accurately reproduced.

A 12-act show-on-wheels, the Pittsburgh Caravan will visit practically every important center in the country. This tour will cover many months, so advance publicity will tell you of its appearance locally. When it reaches your city, you are cordially invited to attend this novel and worthwhile exhibit.

"PITTSBURGH"

STORE FRONTS AND INTERIORS

PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

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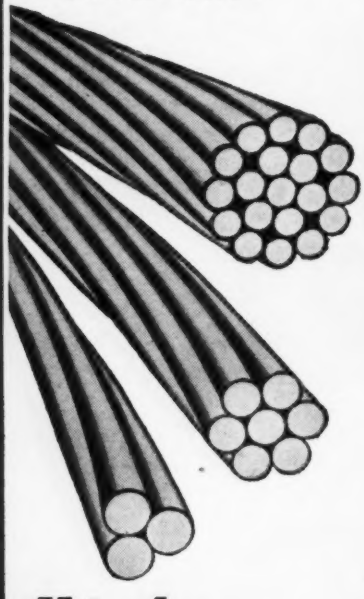

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in Corrosion Resistance
Tensile Strength
Elastic Limit
Resistance to Vibration
Strength to Weight Ratio

Lower

in Cost per Year
of Installed Life

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PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

In Business for Your Safety

the small cutter is more easily fed than the larger ones. From this experience we would recommend the small size if a farmer is going to buy a cutter to be driven by a 7½-hp motor.

Factors influencing the rate of the cutting are the speed of the blowers, sharpness of the knives, the distance between the knives and shear plate, and the ripeness of the forage. For the best results fan-tip speed should not be over 5,500 fpm for a 3-knife cutter, or 6,750 fpm for a 2-knife cutter. The cutting knives should be as close to the shear plate as possible, and knives replaced with sharp ones after four hours of continuous use.

Tests were run on 48-in. Papec, 42-in. Papec, 40-in. Blizzard and 36-in. Papec ensilage cutters. The following table shows the best speeds for each of these cutters for silos from 30 ft to 35 ft in height:

Diameter of Cutter	No. of Knives	RPM
48 in.	3	440
42 in.	3	500
40 in.	3	520
36 in.	2	725

• • •

Mercury Lighting for $9.50 per Month

BEFORE AND AFTER view of downtown Medford, Oregon showing marked improvement in street lighting effected by installation of 32 new 16,000-lumen mercury lamps. City pays interest of $6.70 on power company investment, operating and maintenance costs of $2.80 or total of $9.50 per month per pole

HIGH INTENSITY MERCURY lighting on the main street of Medford, Ore., contrasts strikingly with the antiquated incandescent system it displaced. The installation consists of 32 standards with 6-ft arms, mounting FHI, 16,000 lumen GE mercury lights 32 ft above the pavement. Three units are installed in each 220-ft block, staggered one in

REMINDER:

The spraying season is just about here. Better arrange now to have your right-of-way treated with "ABC" this summer.

now ABC

ASPLUNDH BRUSH CONTROL

KILLS BRUSH RIGHT DOWN TO THE ROOTS

Here are the Facts about Asplundh Brush Control. "ABC" is . . .

HARMLESS. Won't hurt animals or humans.

EFFECTIVE. Kills to ground level at least and, in most cases, the roots themselves.

ECONOMICAL. The cost is in line with cutting one-year growth.

SELECTIVE. Grasses continue to grow; no erosion problem created.

CONTROLLABLE. Drift is no problem.

NON-CORROSIVE. Will not corrode steel towers or other metal structures.

ADAPTABLE. ABC can be used wherever a man can walk.

For further details . . . write for your free copy of the four-color illustrated booklet "Asplundh Brush Control."

ASPLUNDH TREE EXPERT COMPANY

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"ECONOMICAL LINE CLEARING EXCLUSIVELY"

Maintain

CONTINUITY of SERVICE with "Autocall" supervision

When pressure and temperature rise beyond the safety point in transformers, voltage regulators and other liquid or gas-filled equipment, the resulting failure may cost hundreds or thousands of dollars, while in instances where explosions due to excess pressure occur, persons within the area are likely to be killed or injured.

Such disastrous results may be guarded against with the Autocall Combination Pressure and Temperature Unit Type CPT-4 shown above.

With the CPT-4, responsible personnel are automatically warned, *before failure*, of excess pressure and/or temperature, regardless of the location of the equipment under supervision. Such warnings are flashed by Autocall audible and visual-type Annunciators, while a log record of such occurrences is automatically printed in plain English by the Central Office Unit Type PS-2 shown at left above, which affords a complete record of *all* station operations.

Investigate this means of protecting valuable equipment and human life. Send for your copy of the Autocall "Power" Catalog TODAY.

THE Autocall CO.

REG. U. S. PAT. OFFICE

228 TUCKER AVENUE
SHELBY, OHIO

ALSO MFRS. PAGING, FIRE AND SPRINKLER ALARM SYSTEMS

the middle of the block on one side of the street and one at each end on the other side on alternate blocks.

The system was financed and installed by the California-Oregon Power Co. The city pays a monthly charge composed of operating and maintenance cost, together with a small amount for interest on the investment. The operating and maintenance charge is $2.80 per post per month. Added to this is a monthly charge of 1-1/6% of the installed cost, or $6.70, making the total cost $9.50 per month per post or $304 per month for the 32-post system. Estimated installed cost per post was $575.

•

Floating Heater De-ices Watering Trough

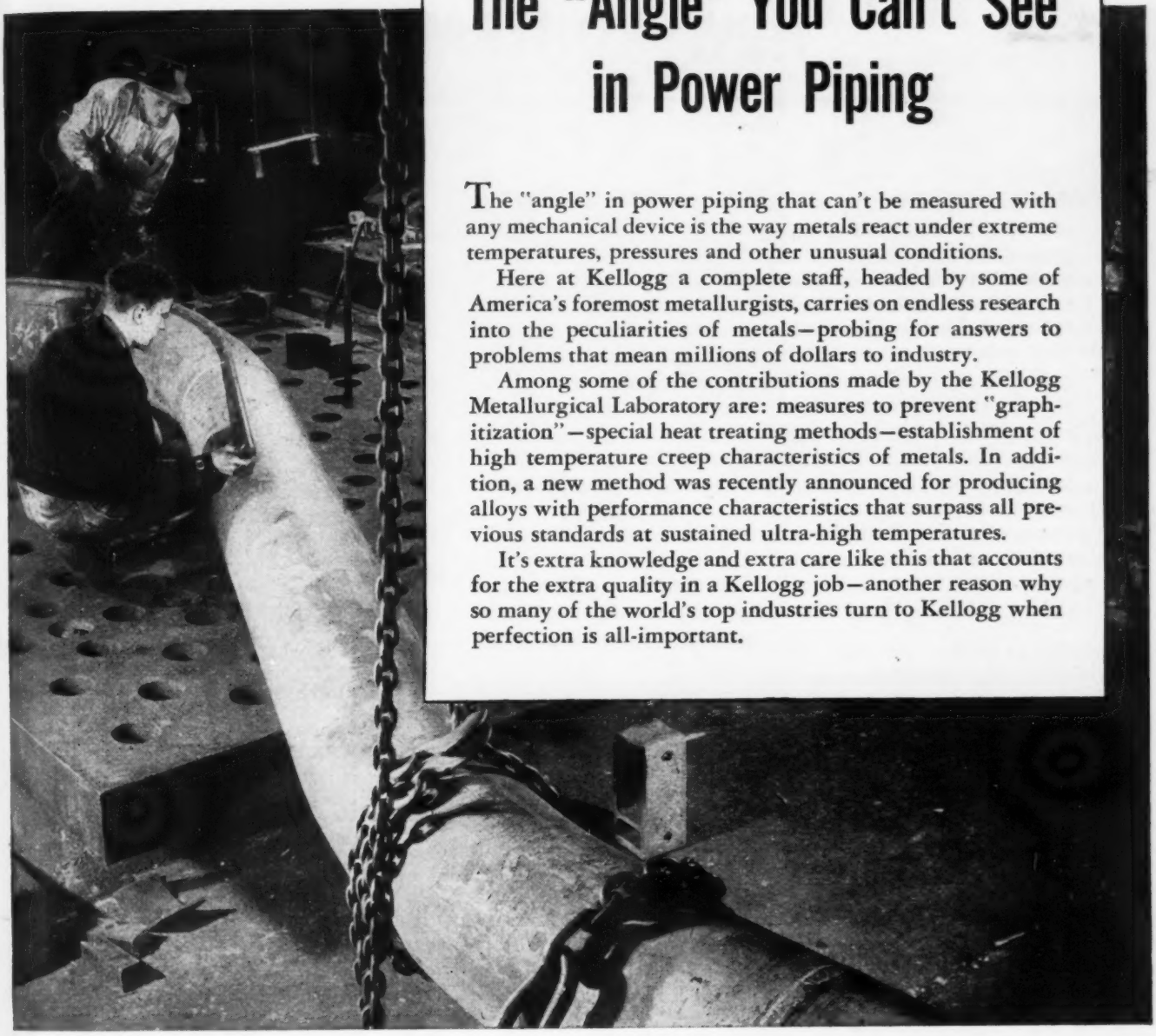
A FLOATING WATER heater that prevents stock watering troughs from freezing over, even in sub-zero weather, was made in the Meadville, Pa. plant of Westinghouse Electric Corp. Farm animals can easily nose the floating heater aside without danger of getting burned or frightened.

The new water trough de-icer is a 2¼-in. thick, 10-in. diam disk of brazed copper float that contains a 500-w heating element controlled by a thermostat. The 16-ft rubber-covered cord plugs into 110/115-v outlet.

In coldest weather, the cost of operating the new de-icer is less than five cents a day. Made of non-corrosive copper, the unit gives off just enough heat to keep a large area in the water trough clear of ice.

FLOATING HEATER stops water freezing

The "Angle" You Can't See in Power Piping



The "angle" in power piping that can't be measured with any mechanical device is the way metals react under extreme temperatures, pressures and other unusual conditions.

Here at Kellogg a complete staff, headed by some of America's foremost metallurgists, carries on endless research into the peculiarities of metals—probing for answers to problems that mean millions of dollars to industry.

Among some of the contributions made by the Kellogg Metallurgical Laboratory are: measures to prevent "graphitization"—special heat treating methods—establishment of high temperature creep characteristics of metals. In addition, a new method was recently announced for producing alloys with performance characteristics that surpass all previous standards at sustained ultra-high temperatures.

It's extra knowledge and extra care like this that accounts for the extra quality in a Kellogg job—another reason why so many of the world's top industries turn to Kellogg when perfection is all-important.

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INC.

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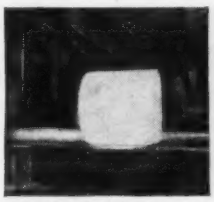
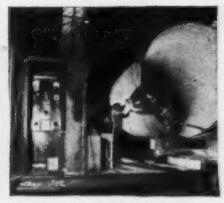
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

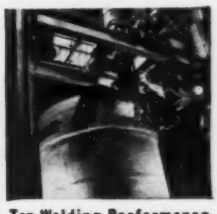


Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.



Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.



Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

NEW EQUIPMENT

Sign Transformers

A NEW LINE OF HANGER transformers designed for suspension-type luminous-tube signs has been announced by the Specialty Transformer Division of the General Electric Co. At the same time, announcement of two improved inverter-transformers for the operation of luminous-tube signs on trucks and automobiles was made.

The new hanger transformer (illustrated) incorporates a built-in low-voltage junction box having a primary pull switch mounted on the cover. A 6-ft primary cord set is furnished, consisting of three conductors with 2-prong plugs, and a separate ground lead. Also supplied are secondary leads of GT cable, 30 in. in length. Enclosing cases are narrow in width, permitting easy installation in restricted spaces.

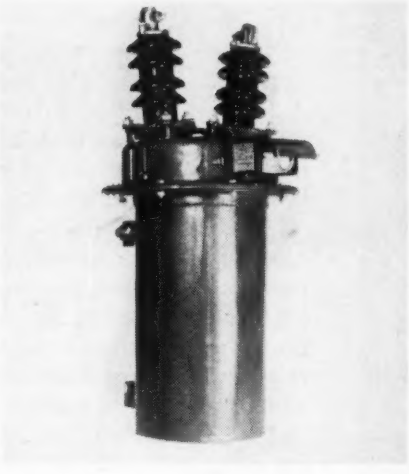
The new inverter-transformers utilize an improved design which is said to result in better vibrator performance.

Average operating life of the vibrator exceeds 500 hr. Plug-in construction makes vibrator replacement easy. The new units are reported to have a battery drainage smaller than that of an automobile radio. They are furnished for operation from a 6 or 12-v d-c source.

•

Automatic Recloser

A NEW RELAYED automatic recloser designed for rural lines has been announced by the General Electric Co, Schenectady, N. Y. Designated type FR-1, it is available with continuous current ratings of 5, 10, 15, 25, 35, and



50 amp and with interrupting ratings 25 times continuous rating; it may be used on circuits 2400 to 15,000 v.

The new recloser offers a choice of two operating functions—either two instantaneous openings plus two time-delay openings to lock-open, providing wide range co-ordination to fuses; or two instantaneous openings to lock closed, providing extended co-ordination to fuses over an even greater range of current values. It is easily convertible in the field.

A mechanical escapement timer gives precise opening characteristic on both instantaneous and time-delay operations. Arc interruption is quickly accomplished in an oil-blast interrupter chamber.

Manual closure (after lock-open) automatically places the timing mechanism on time-delay operation to avoid unnecessary re-tripping on transient inrush currents. After only 13.5 sec the timing mechanism automatically resets for normal operating sequence.

•

Lighting Units

LIGHTING FIXTURES using "Alumnispun" reflectors and circular fluorescent lamps have been developed in two sizes by McCulloch Manufacturing Co, Marietta, Ga. The fixtures are designed for surface ceiling mounting and suitable for office, store and residential applications. Made of spun aluminum, these units have reflecting surfaces that are etched, lacquered, and designed to deliver maximum light at useful level.

The units have Circline tube, General Electric ballast and accessories, and adjustable fixture hanger strap. They operate at 110-118v a-c. Model 15 with 22-w, 8-in. tube is 15¼ in. overall diameter and 4½ in. in depth. Model 19 has a 32-w, 12-in. tube and is 19¼ in. overall diameter and 5 in. in depth.

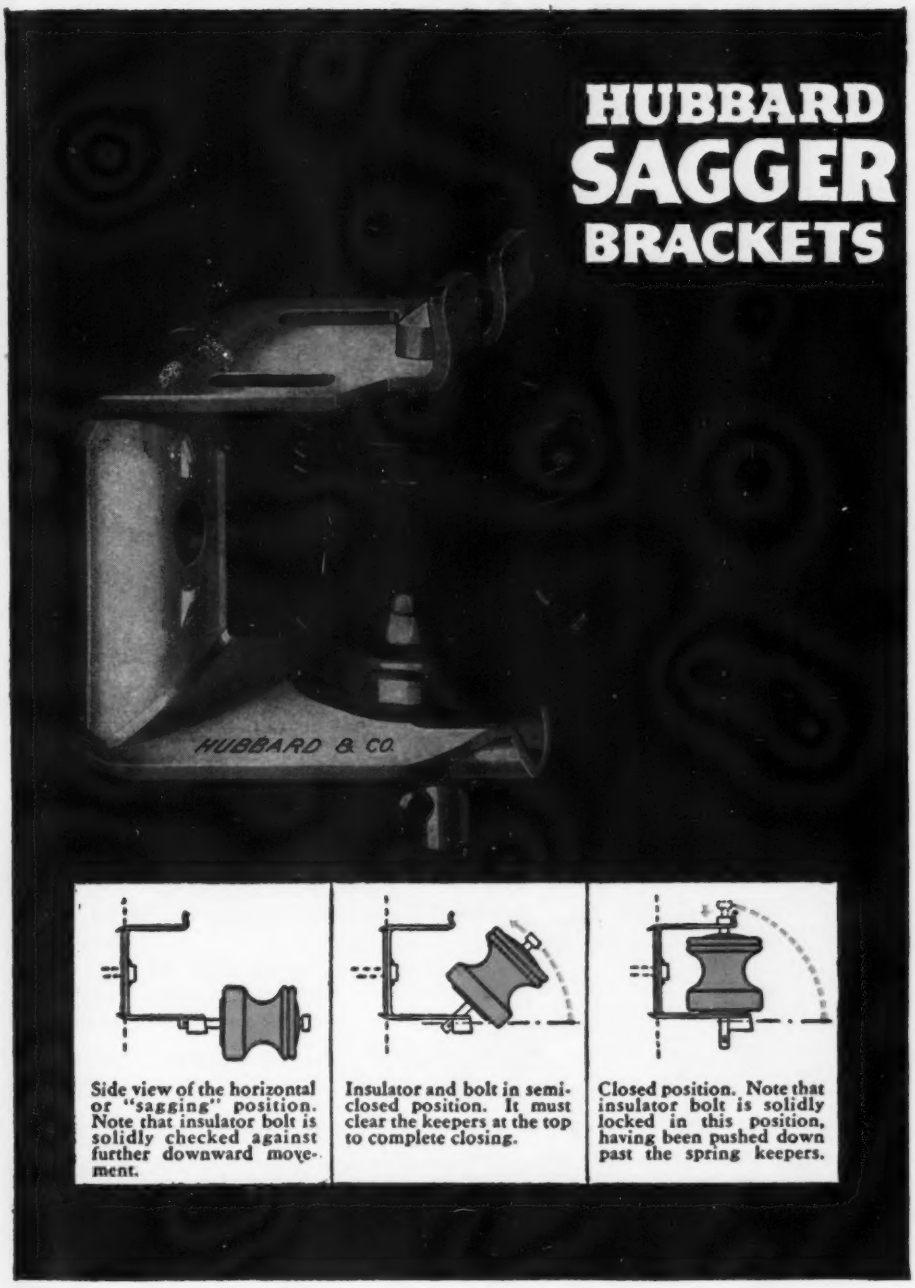
•

Industrial Transformer

A NEW LINE OF dry-type transformers equipped with built-in primary circuit breakers and thermal overload protection has been announced by Westinghouse Electric Corp, Pittsburgh 30, Pa. They are suitable to supply industrial lighting and small-power circuits from industrial power circuits. Complete in themselves. these transformers are designed to be connected directly to open or conduit wiring, eliminating the necessity of providing junction boxes, primary switches, fuses, or circuit breakers.

The circuit breaker handle projects through the front of the transformer

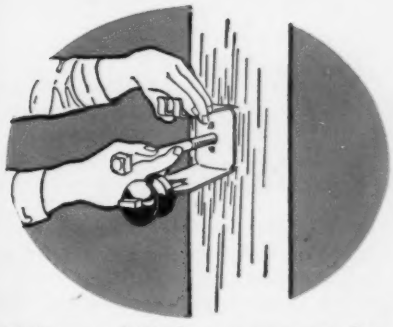
Something NEW IN SECONDARY DISTRIBUTION



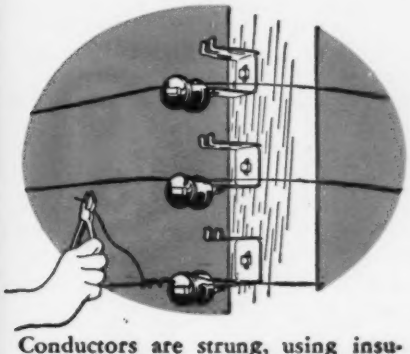
Side view of the horizontal or "sagging" position. Note that insulator bolt is solidly checked against further downward movement.

Insulator and bolt in semi-closed position. It must clear the keepers at the top to complete closing.

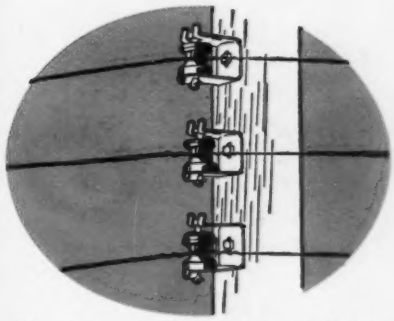
Closed position. Note that insulator bolt is solidly locked in this position, having been pushed down past the spring keepers.



Holes are drilled at correct spacing and machine bolt is inserted as shown.



Conductors are strung, using insulators as pulleys, until desired sag is obtained after which they are tied-in while still in the horizontal position.



After tying-in, the insulator bolts are raised to the vertical and dropped into the lock position.

For secondary distribution circuits, where a variety of problems are to be met, Hubbard No. 710 Sagger Bracket is the most flexible choice to meet the requirements. This Bracket may be described as a single, *separate,* secondary-rack point, which may be used with one or more similar points, at any desired spacing for any number of conductors.

No. 710 Brackets are versatile in other ways also. The patented feature is the arrangement of the insulator bolt which may be dropped to a horizontal position to allow the "sagging" of conductors with the insulator spool acting as a pulley. Insulator Bolts are locked in position when closed or open. Strength against line pull is provided by the broad back bearing against the pole, the backs being 3-inches in width. Spurs at the corners prevent the bracket from turning during and after installation. Bolt heads are trapped in the back to prevent turning while tightening.

Hubbard Sagger Brackets have been tested and proved in service. Highly adaptable to any conditions, they have drawn praise from engineers, in every instance of the many installations made to date.

HUBBARD AND COMPANY

PITTSBURGH • CHICAGO **OAKLAND • CALIFORNIA**

NORTH • EAST • SOUTH • WEST • IT'S SCHRAMM!

CHOOSE *as others have* **THE MODEL THAT BEST FITS YOUR NEEDS!**

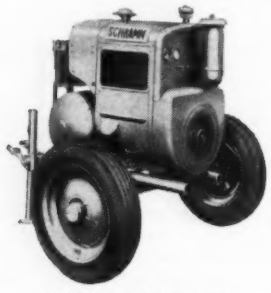
There's a Schramm Air Compressor, size and model, to meet your specific needs!

Below are listed nine of the many Schramm models, portables ranging from 20 to 420 cu. ft. of actual air, the stationary ranging from 2 to 600 cu. ft. displacement.

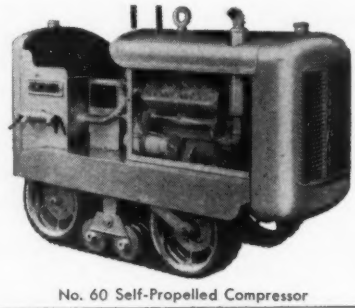
On all models performance records are evidence of their high quality. You will find the name Schramm written on every important page in compressor history.

Features you get in Schramm are: 100% water cooled, assuring ideal performance summer and winter; mechanical intake valve, forced feed lubrication, and electric-starter starting. All Schramms are compact, lightweight, easy to operate.

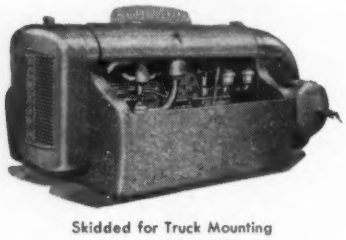
We invite you to write today for fully illustrated catalog describing in detail each of the Schramm Air Compressors shown here . . . plus a wide range of other models. We feel the Schramm story is a good one, and offers you a sure way to get your many compressed air jobs done quickly, efficiently, and economically.



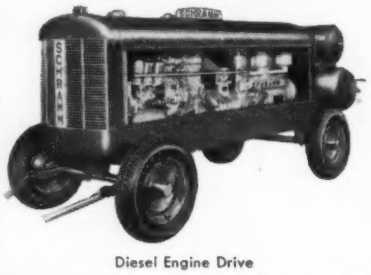
20/35 Model Compressor



No. 60 Self-Propelled Compressor

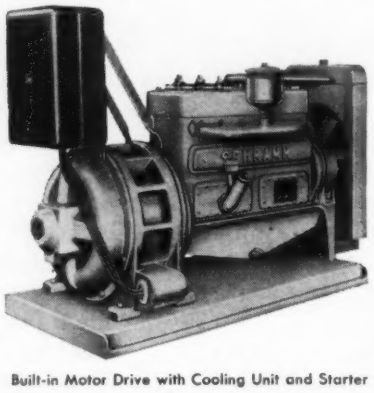


Skidded for Truck Mounting



Diesel Engine Drive

"V" Belt on Flat Pulley Drive



Built-in Motor Drive with Cooling Unit and Starter

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

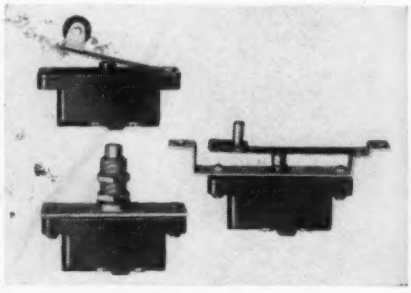
case and is easily accessible. The thermal trip elements on the circuit breaker prevent damage to the transformer from short circuits or from excessive overloads but permit nondamaging short-time overloads to be carried safely.

Ratings are available from 3 through 50 kva for 240 to 120-240 v, 480 to 120-240 v, or 600 to 120-240 v, single-phase, 60 cycles.

•

Switch Operators

FOR THEIR PRECISION snap switches Square D Co, Industrial Controller Division, 4041 North Richards St, Mil-



waukee 12, Wis. has announced a new series of operators.

A—Plunger type has a mechanism consisting of a brass tube containing an operating button and an overtravel spring. It mounts in ½-in. diam hole on panels up to ⅝-in. thick.

B—Roller-leaf type has a beryllium copper operating arm riveted to the basic mechanism. At other end of the arm is a non-metallic roller assembly.

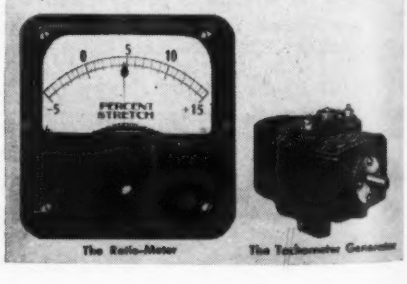
C—Door type has a bracket with two mounting holes and a beryllium copper operating arm.

•

Speed-Ratio Tachometer

A NEW SPEED-RATIO tachometer has been announced by Weston Electrical Instrument Co, 617 Frelinghuysen Ave, Newark 5, N. J. It is designed to provide accurate control in processes wherein materials are subject to change due to differences in the rate of travel.

The unit includes two small d-c generators and a speed-ratio indicating instrument. The generators are connected to the input and output drives of a machine and wired to the indicator. The indicator, or ratio meter is mounted con-

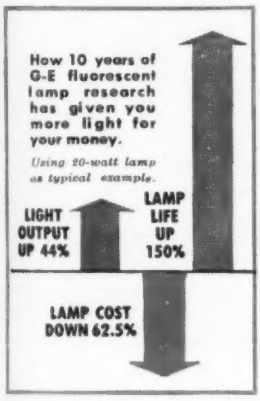


The Ratio-Meter

new light old April 21

ONLY 10 short years ago, the first fluorescent lamps were placed on public sale by General Electric. Since then G-E fluorescent lamps have revolutionized lighting in stores, offices, institutions, factories, homes—opening a vast, new field of opportunity in electrical service.

From the first, G-E Lamp scientists have led in fluorescent development, working ceaselessly to bring the cost of fluorescent lamps lower and lower—to raise efficiency higher and higher. The chart shows what's happened.

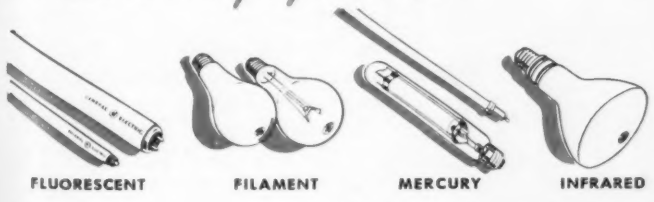

How 10 years of G-E fluorescent lamp research has given you more light for your money.
Using 20-watt lamp as typical example.
LIGHT OUTPUT UP 44%
LAMP LIFE UP 150%
LAMP COST DOWN 62.5%

This amazingly rapid improvement in fluorescent is typical of the persistent effort of General Electric to help utilities give their customers higher and higher levels of lighting. And you can count on G-E lamps as increasingly valuable tools in selling Planned Lighting—because research is always at work to make G-E lamps *Stay Brighter Longer!*

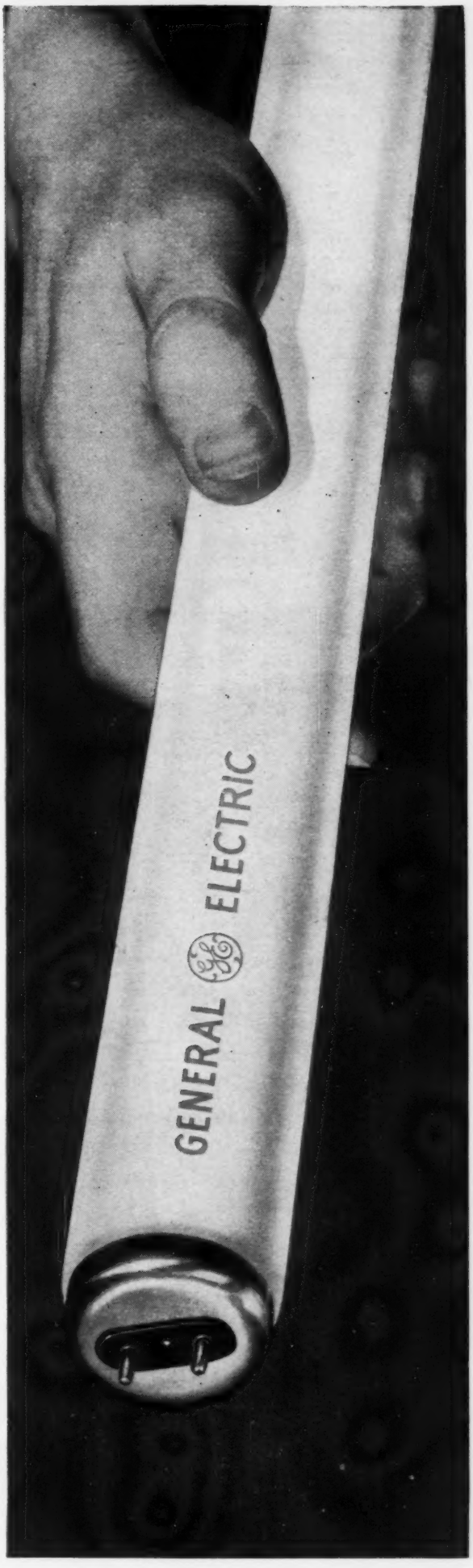
G-E LAMPS

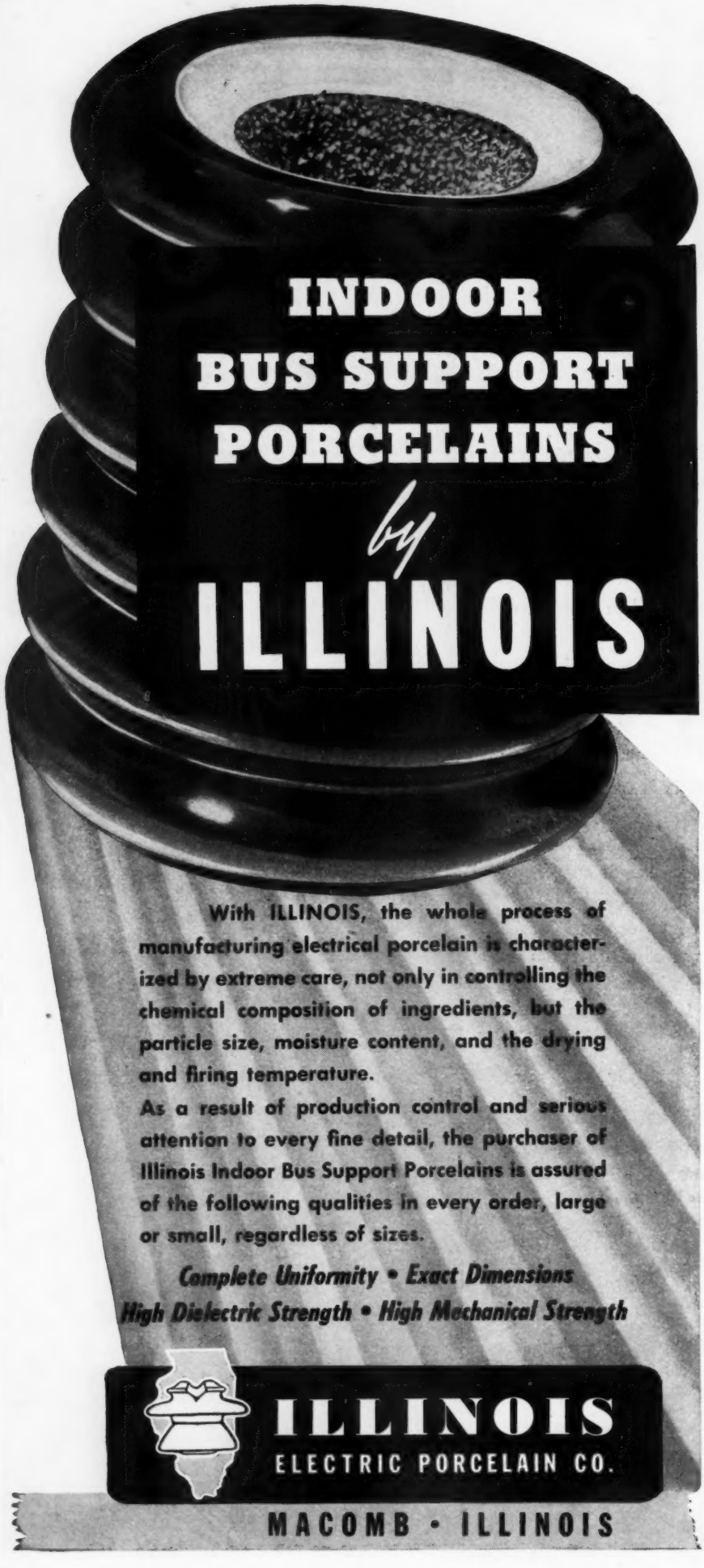
GENERAL ELECTRIC

Whatever lamps you need



-G-E makes 'em all





With ILLINOIS, the whole process of manufacturing electrical porcelain is characterized by extreme care, not only in controlling the chemical composition of ingredients, but the particle size, moisture content, and the drying and firing temperature.

As a result of production control and serious attention to every fine detail, the purchaser of Illinois Indoor Bus Support Porcelains is assured of the following qualities in every order, large or small, regardless of sizes.

Complete Uniformity • Exact Dimensions
High Dielectric Strength • High Mechanical Strength

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB • ILLINOIS

veniently for the operator and calibrated in whatever terms are desired, such as percent stretch, percent shrinkage, percent elongation and feet per minute. An additional indicator can be wired for use at a distance.

•

Thermal Fuses

THE SAF-T-LAG FUSE with a long time-lag is a new product of Jefferson Electric Co, Bellwood, Ill. Both ends of the current-carrying copper fuse strips (B) are alike to allow more accurate calibration and to prevent un-

equal heating of the end areas. The trigger spring (A), which also carries current, is a copper alloy and breaks the circuit at a temperature of 280 F.

The fuse is available in popular sizes. It is claimed to insure long service and precision protection against dangerous overloads, short-circuiting overheating from extraneous causes and motor turnouts due to single phasing of polyphase motors.

•

Load-Center Transformers

DRY TYPE CLASS B insulated load-center transformers for plant power distribution circuits are now being built by Wagner Electric Co, 6400 Plymouth Ave, St. Louis 14, Mo. Ratings available are 3-phase, 60-cycle, 100 to 2000 kva, with high voltages of 2400, 4160, 4800, 7200, 12,000, 13,200, or 14,400, and low voltages of 600, 480, 240 or 208Y/120. All are rated 80 C rise, with natural ventilation.

Transformers are housed in paneled enclosures designed for indoor installation. Matching compartments for primary and secondary switchgear can be furnished as required, to form complete, closely coupled unit substations. Illustration shows an enclosure with front panels removed; a high-voltage

FOR Aluminum Armor Rod

THIS NEW CONNECTOR IS EASIER AND QUICKER TO INSTALL

BLACKBURN *Hi-Strength* CONNECTORS

Check These Features!

1. **SPLIT BOLT TYPE**—No other connector is as simple to install as the split bolt type illustrated above.
2. **TRUE BI-METAL CONSTRUCTION**—The separating washer is copper on one side and aluminum on the other side, and the two metals are bonded together. So the armor rod is completely surrounded by aluminum, and the copper is completely surrounded by copper to prevent electrolysis.
3. **ALUMILITE TREATED NUT**—to prevent seizing of threads. Nut is easily removed.
4. **A HIGH STRENGTH CONNECTOR**—The nut and screw are made of a high strength aluminum alloy, and may be installed tightly over the armor rod to insure a good and lasting connection.

R. E. A. APPROVED

Available for Prompt Delivery!

See Your Jobber and Specify These Catalog Numbers:

For ALUMINUM TO COPPER

Line	*Tap*	*Cat. No.*
6 Armor Rod	6 Copper	*6 ARC
4 Armor Rod	4 or 6 Copper	*4 ARC

For ALUMINUM TO ALUMINUM

Line	*Tap*	*Cat. No.*
6 Armor Rod	6 ACSR	*6 ARA
4 Armor Rod	4 ACSR	*4 ARA

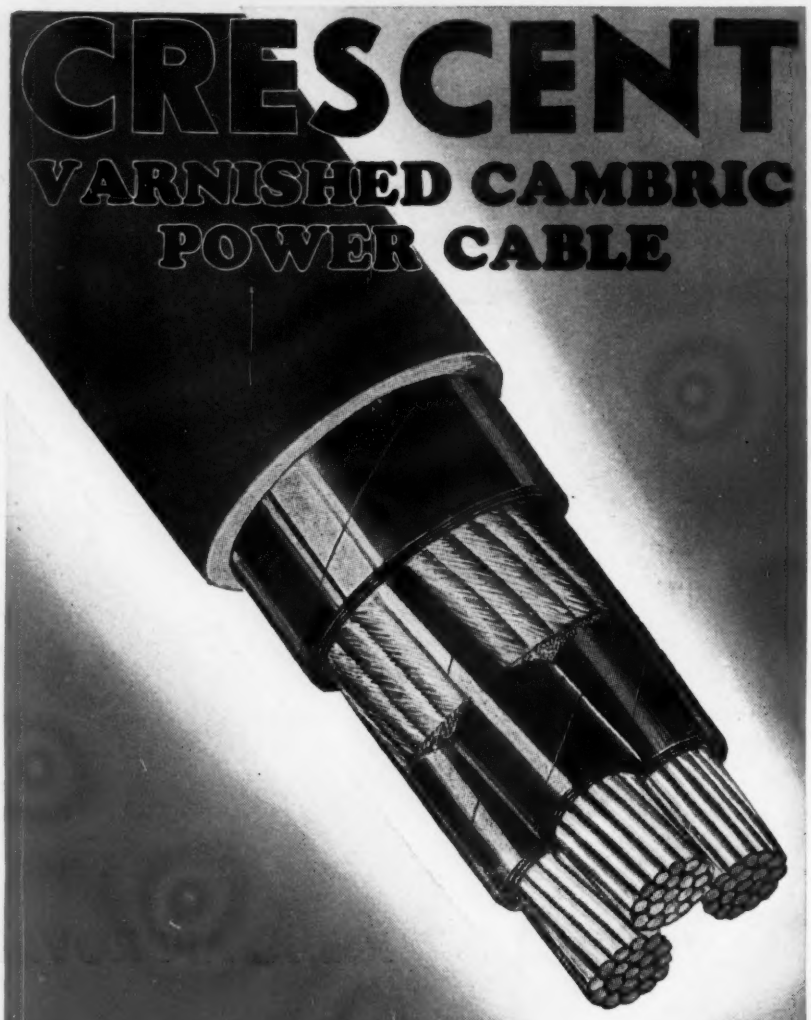
*Type ARC illustrated. Type ARA is all-aluminum construction.

Listed by Underwriters

FIRST, MADISON & CLINTON STS. • **JASPER BLACKBURN PRODUCTS CORP.** • ST. LOUIS 6, MISSOURI

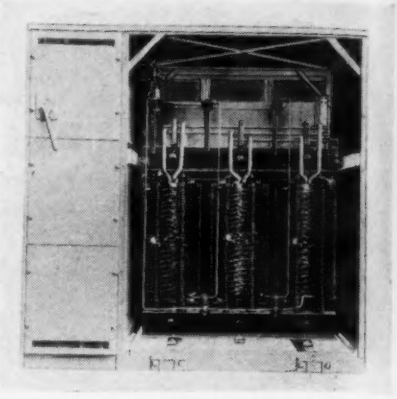
BUILDERS OF QUALITY CONNECTORS FOR OVER 10 YEARS

CRESCENT
VARNISHED CAMBRIC
POWER CABLE



Heavier loads for longer periods of time than formerly possible are obtainable with CRESCENT VARNISHED CAMBRIC CABLE. This general-purpose, industrial power cable provides higher current carrying capacity for the same size of copper conductors, together with maximum safety and permanence.

CRESCENT
WIRE & CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.



interruption switch is located in closed compartment.

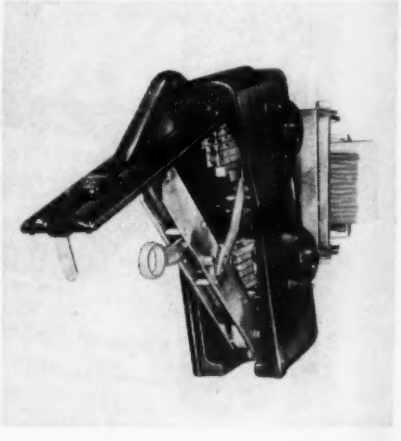
Vertical ducts through the core and vertical and horizontal ducts through the transformer winding provide ventilation and reduce internal temperatures. Additional information, electrical, mechanical and accessories, are given in Bulletin TU-56.

•

Disconnect Switch

A NEW DESIGN of a porcelain-enclosed disconnect switch designated as ES has been announced by S&C Electric Co, 4435 North Ravenswood Ave, Chicago 40, Ill. Application is on distribution systems up to 7500 v, and having current ratings 200 to 600 amp.

The switch is reported to have greater current carrying capacities than that afforded by ordinary light duty cutout box form of disconnect. It is con-



structed to cope with conditions such as being left open for a long time, with contacts exposed to corrosive influence of atmospheric conditions.

•

Temperature Transducer

DESIGNED FOR telemetering applications, a 1-in. diam temperature transducer is made available by G. M. Giannini & Co, 285 West Colorado St, Pasadena 1, Calif. A bi-metallic element

INTRODUCING
The First Really

NEW and DIFFERENT

FLUORESCENT FIXTURE

The Achievement of GUTH'S 45 Years of Lighting Leadership

Guthlite*

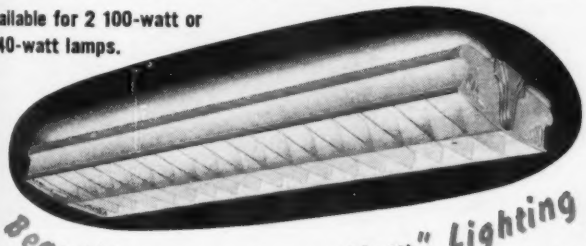
—For Better Sight

Featuring the Exclusive "Jacknife" Hinge!

Installation Is Fast... Easy!

The ballast-free channels are hung first—either on the ceiling or suspended—singly or in continuous rows. Then follows simple, straight-through, unobstructed wiring. Finally, the complete reflector unit, which contains reflector, ballast, starter, wiring, lamp holder, lamps, and louvres, is put up in one simple, hook-on operation. That's all there is to it!

Available for 2 100-watt or 2 40-watt lamps.



Beautiful "Radiant Glow" Lighting

The GUTHLITE provides efficient, glareless, down light, comfortably pleasing ceiling light, and beautiful soft-lighted sides. There are no horizontal light-reflecting surfaces to gather dust.

The reflector and Exterior are finished 300° PERMALUX WHITE, with satin finish ALZAK aluminum louvres, polished aluminum end ornaments, (removable when used in continuous rows), and decorative die-cut light windows in ends. A truly beautiful luminaire. Write today for detailed information—Bulletin No. 1845C.

Lamps Replaced—Starters Changed—Reflectors Cleaned—All Right from the Floor! No Ladders—No Fuss!

Here is the fluorescent fixture that solves, once and for all, every problem in fluorescent lighting! Easy and fast installation. Simple, safe, time-saving maintenance. A fixture that symbolizes the progressive, forward-looking achievements of GUTH—pioneers in lighting!

"Jacknife" Hinge Makes It Simple to Service As 1-2-3!

1—A twist of the wrist opens the spring latch—releases the reflector unit to swing down, smoothly and safely, on the "Jacknife" Hinge.

2—Reeled spring counter-balance reflector channel; means easy lowering and raising. Circuit is broken as soon as Fixture is opened.

3—From the floor, lamps and starters can be changed; reflectors and louvres can be dusted. As an added feature, the entire channel can be unhooked and removed for thorough washing.

THE EDWIN F. GUTH CO. • ST. LOUIS 3

Leaders in Lighting Since 1902

Guth

*Trade Mark. U. S. & Canadian Patents Applied for

Turning "low hours" into "high load"—for you!

Here's a load-builder that works from *midnight to morning.* The General Electric Automatic Blanket!

And here's the kind of load you can expect—Two G-E Blankets equal one six-foot refrigerator in kilowatt hour consumption.

We're telling the story of G-E Automatic Sleeping Comfort. With full-color advertising in *Life, House Beautiful, Good Housekeeping, Time, This Week,* and *National Geographic.* And with plugs on the coast-to-coast radio show, "The G-E House Party."

Your customers—like more than half a million other enthusiastic users—are sure to love these cozy-warm, lightweight, electrically controlled blankets. So why not suggest them as gifts—for weddings, Easter, Mother's Day, birthdays.

Remember—*only* General Electric—the original automatic blanket—is available in a *full line.*

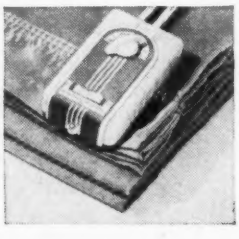
The One-Control Blanket (for three-quarter or double beds). The exclusive Two-Control Blanket for double-bed sleepers who like *different* degrees of sleeping warmth. And an exclusive new Twin-Bed Size in the One-Control model.

Write us today for ways to make this great "low hour" load-builder work for you! Appliance and Merchandise Department, General Electric Co., Bridgeport 2, Connecticut.

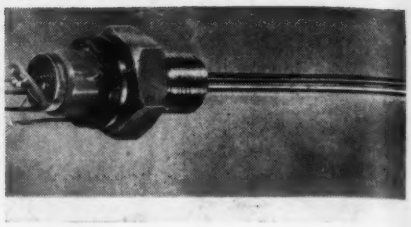
Automatic Blanket

"Goes to work when the lights go out"

Approved by Underwriters' Laboratories, Inc.



GENERAL ELECTRIC



encased in a small tube rotates a micro-torque potentiometer.

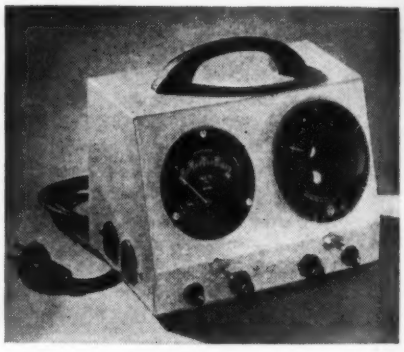
The type 4911 unit is said to have a linearity of 1%, an accuracy of 1%, and a sensitivity of 1 C or less. It is designed for a temperature range from minus 65 C to plus 150 C. Standard resistance for the instrument is 5,000 ohms, but resistances are available from 100 to 20,000 ohms.

•

Voltage Control Box

A PORTABLE, SELF-CONTAINED voltage control unit, measuring 9 x 8 x 7 in. is made available by Andrew Technical Service, 111 East Delaware Place, Chicago 11, Ill. The unit is suitable for laboratory control, research work and field use.

The device contains a 405-w variable

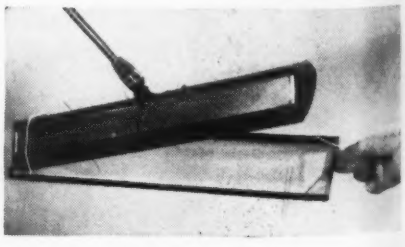


autotransformer and a 0-150 voltmeter. Input rating is 115, 50-60 cycles, single phase. Output is variable from 0-135 v. Four plug-in load receptacles are furnished. Each pair is controlled by a toggle switch, has a pilot light, and is protected by a cartridge type screw-fuse.

•

Polarized Light

PLATES WITH A medium known as Polaply to distribute light radially have been developed by Polarized Il-

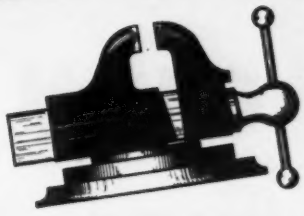


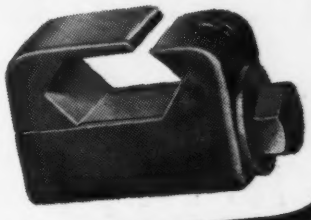
FARGO "ONE PIECE" CONNECTORS

Built LIKE A **Vise**

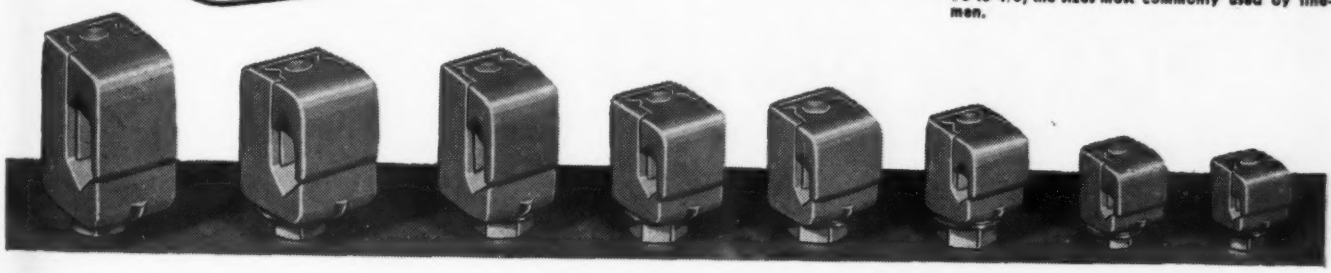
Grip LIKE A **Vise**

Easy TO USE AS A **Vise**





Available in sizes from #8 to 1,000,000 CM. Two sizes of bolt heads (3/4" and 5/8") fit the range from #8 to 4/0, the sizes most commonly used by linemen.



"Easy-to-use" TOOLS, TOO!

Although any open end, adjustable or socket wrench will do . . . each of the following styles will fit the eight sizes (#8 to 4/0) linemen use most frequently. They are handy, speedy . . . and fit a number of other applications, too.

GP 200

A standard socket with one size on each side of the head.

GP 201

A flat ratchet with box type sockets on each end.

GP 202

The GP 200 with a molded handle which offers a better grip and insulates the handle.

Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin

FARGO

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N. Y.

LM

The Makers and Distributors of

CHAMPION

FLUORESCENT and *Incandescent* LAMPS

For Every Industrial Service Urge You to Make the Most of

PLANNED LIGHTING

For better products and increased production at lower overall cost *plan your lighting* before you buy lamps or fixtures.

CHAMPION helps you:

1. By supplying the finest quality, longest lasting lamps that forty-eight years of specialized experience in the manufacture of lamps for industry can produce.

2. By concentrating on low overhead and direct sale through qualified industrial suppliers to assure you minimum lamp and lighting cost.

3. By stationing trained lighting experts in industrial centers to furnish prompt, dependable recommendations on all lamp or lighting problems.

Let us mail you a copy of the Champion Maintenance Manual M. It's full of useful hints on how to make the most of *planned lighting.*

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

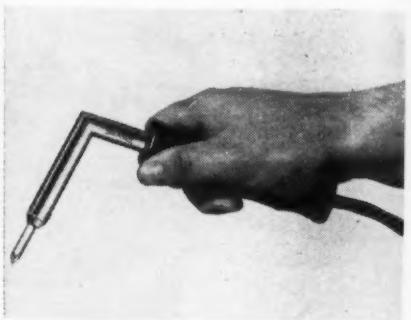
lumination, Inc, Whitestone, L. I., N. Y. The multilaminar plastic polarizer is sandwiched between clear glass.

The plates will be available for fluorescent or incandescent lighting fixtures. One attachment 19 in. long by 4¾ in. wide can be obtained for fluorescent desk lamps. Two springs allow easy adjustment. A protective frame prevents stray light leakage.

•

Soldering Iron

WEIGHING ONLY 5½ oz (less cord) is a catalog 30H soldering iron which has been added to the line produced by Hexacon Electric Co, 206 West Clay Ave, Roselle Park, N. J. The



hatchet-design unit can be connected to a 110 or 220-v, a-c or d-c circuit. A 40-w size has a ¼-in. diameter tip. Irons in 50 or 60-w sizes and with ⅛-in. diameter tips can be furnished.

•

Motor Starter

FOR PROTECTING 2,300-4,600-v motor circuits against damage from short circuits, The Electric Controller & Mfg Co, Cleveland 4, Ohio, announces a new line of motor starters.

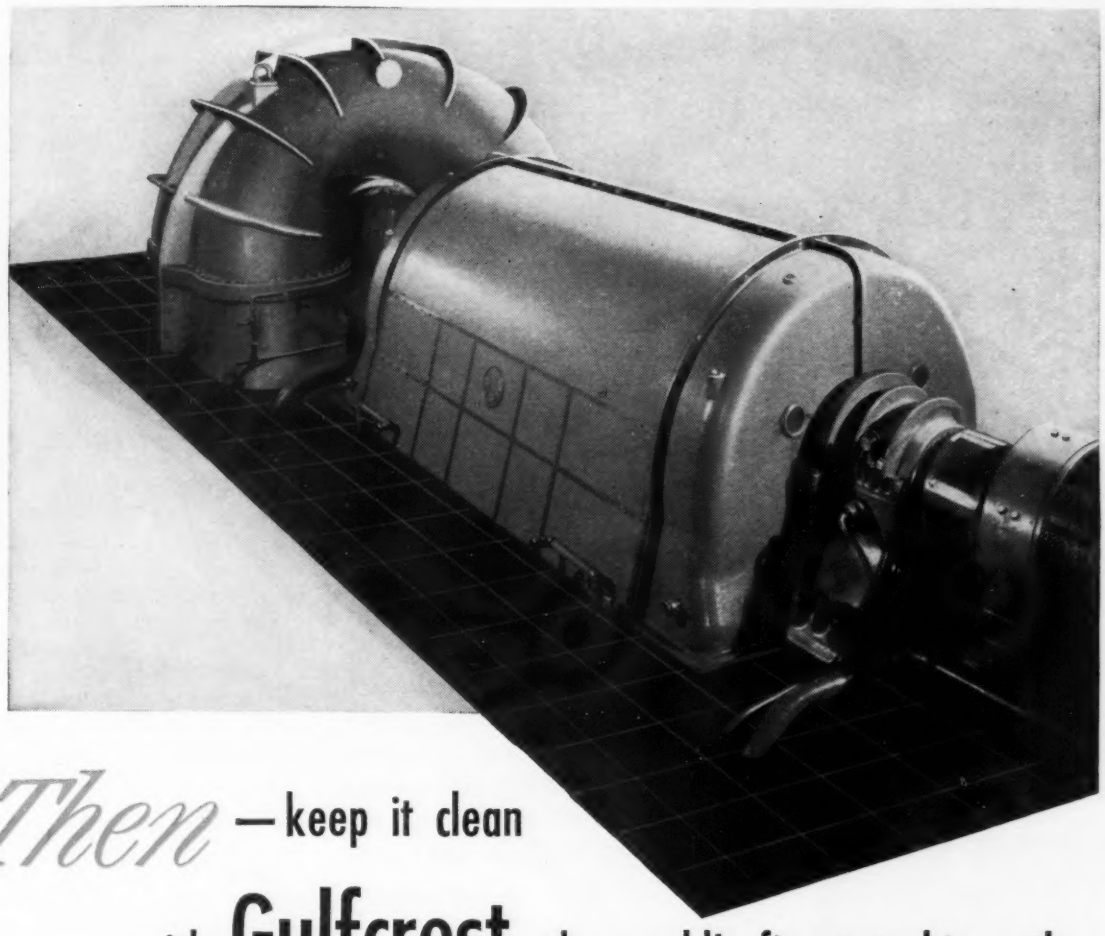
Known as the Valimitor (volt-ampere-limitor) motor starters, they are designed for use at any point on any power system, regardless of the available kva. it is reported. An additional claim is that these new starters limit maximum obtainable fault current to a value independent of the kva capacity of the power system. Interruption is by type ZHS magnetic contactor. The manufacturer reports also that the installation remains permanent; that there is nothing to change should power capacity be increased at a future date; and that there is nothing to replace when a fault occurs.

Being a self-contained unit, upper half of cubicle contains disconnect switches and Valimitors; lower half mounts magnetic overload relays, also automatic field-switching panel when the starter is used for synchronous motors. Magnetic contactor for main circuit of squirrel-cage, wound-rotor and

First — make sure the lubricating system is clean

with Gulf Turbine Flushing Oil

- *cleans effectively*
- *protects against rust*
- *does not affect lubricating qualities of turbine oil*



Then — keep it clean

with Gulfcrest, the world's finest turbine oil

BY taking these two steps, you can insure top lubricating efficiency down through the years for your new steam turbine.

The use of Gulf Turbine Flushing Oil—before the initial fill of lubricating oil — will remove grease type slushing compounds and carry away harmful abrasives which might be in the circulating system. Thus you make sure the system is clean—and avoid the possibility of trouble caused by contaminants.

For the finest lubrication — longer-lasting protection — it will pay you to investigate the advantages of Gulfcrest Oil WCR. Because of its outstanding resistance to oxidation—it's Alchlor-processed — Gulfcrest Oil WCR lasts indefinitely. With this quality oil and good operating practice, you can be sure there will be no sludge deposits in cooler tubes, bearing pedestals, or oil lines to worry about.

To get these benefits for your new turbines, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

300 Guernseys and he's his own cow-hand...

Talk about riding herd—the owner of this farm can do it from his backyard. He depends on an electric cow-hand.

Charged fences keep many herds in pasture—just one example of how electrification has helped streamline farm work—save time and labor.

Power for many of these modern farms is carried on pole-lines equipped with Hemingray Power Insulators. These glass insulators for electrical distribution systems are made under the most carefully controlled conditions by a pioneer company in the glass insulator field.

Principal jobbers carry stocks of Hemingray Power Insulators and are making prompt shipments.

•

Every lot of Hemingray Power Insulators is tested under methods set by American Institute of Electrical Engineers in specifications No. 41-1944 (ASA C 29-1944) and by the American Society for Testing Materials D-730-43T.

HEMINGRAY

POWER INSULATORS

American Structural Products Company

MUNCIE, INDIANA

SUBSIDIARY OF OWENS-ILLINOIS GLASS COMPANY

synchronous motor is mounted in oil tank at rear.

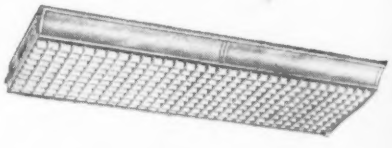
These starters can be used for full-voltage or reduced-voltage starting. Top ratings include: At 2,300 v, 600 hp for 60-cycle systems and 300 hp for 25-cycle systems; at 4,150 and 4,600 v, 600 hp for 60-cycle service and 250 hp for 25-cycle service.

•

Lighting Fixtures

EXECUTIVE LUMINAIRE is a newline of fluorescent and slimline lighting fixtures produced by All-bright Electric Products Co, 3917 North Kedzie, Chicago 16, Ill. It is wafer-thin in depth.

The line includes 2 and 4-lamp units



with louvered or glass bottoms, for standard 40-w fluorescent and 51-w slimline sizes. Finish is baked white enamel said to have a reflection factor of 87%. Wiring is included.

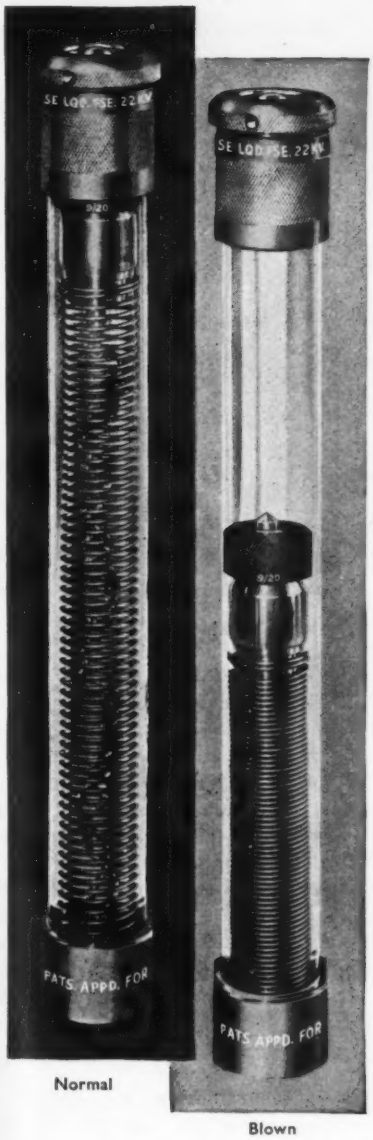
•

Combustion Safeguard

A PHOTOELECTRIC scanner type 45-P45 for flame failure protection on oil burners has been introduced by Combustion Control Corp, 77 Broadway, Cambridge 42, Mass. It is mounted on the burner and consists of phototube and vacuum tube amplifier in a dust-tight aluminum case. Features are an optical system with a heat-absorbing filter, and a hinged shutter permitting lens cleaning without burner shutdown.

The scanner is used in combination with control type 24 QJ5 to provide operating protection of the oil burner installation, and with programmer type 24 PJ8 if starting protection and automatic ignition are required.

'SE' High Voltage Rewirable Liquid Fuses



Normal

Blown

- **REWIRABLE BY USER.**
- **EASE OF REWIRING;** one tool only to rewire in thirty seconds ON SITE.
- **SEALING DIAPHRAGM;** using patent metal-to-metal captive gland, prevents leakage under all conditions of weather and temperature. No hygroscopic gaskets used.
- **PREMATURE VENTING AVOIDED.**
- **PATENT PUSH PULL DEVICE** quickly and efficiently secures element to spring assembly.
- **SMALL SCREWS, WASHERS AND RIVETS** entirely eliminated.
- **LOW COST OF SPARE ELEMENTS, ETC.**
- **ABSOLUTE ACCURACY** in manufacture and performance of replaceable fuse elements ensured by special factory methods of production and assembly.
- **EXTERNAL DIMENSIONS AND RUPTURING CAPACITY** identical with existing standards, for all voltages up to 132,000 volts.
- **PATENTS APPLIED FOR IN U.K. AND U.S.A.**

Switchgear and Equipment Ltd.

BANBURY • ENGLAND

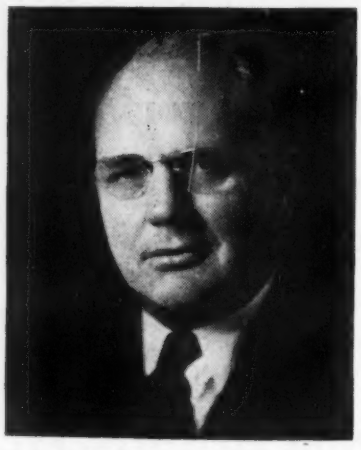
CABLES - SWITCHFUSE BANBURY

NEWS ABOUT PEOPLE

Bailey Directs Operations for Florida Power Corp

J. F. Bailey, vice-president of the Florida Power Corp, St. Petersburg, has been appointed vice-president in charge of operations. Mr Bailey is also president of the Georgia Power & Light Co, Valdosta.

A veteran of 32 years in the utility business, Mr Bailey served in various



J. F. BAILEY

executive positions with utilities in the Middle West bfore joining the Florida-Georgia companies in 1930. In that year he became identified with Florida Power as a division manager, eight years later was named vice-president and general manager of Georgia Power & Light Co and subsequently president.

In 1944 Mr Bailey became assistant to the president of Florida Power Corp and in this capacity was in direct supervision of all local and division managers of the two companies and also the new business department. The following year he was made a vice-president of the Florida utility.

•

▶ G. S. Dunn, commercial manager for the Kentucky-West Virginia Power Co in Ashland, Ky., since 1926, has been appointed director of personnel and public relations for the Appalachian Electric Power Co, Roanoke, Va.

▶ Gordon R. Hahn, superintendent of construction at the Hellgate station of the Consolidated Edison Co, New York, has been appointed an adjunct professor of mechanical engineering, Stevens Institute of Technology, Hoboken, N. J. Mr Hahn is one of eight engineers appointed adjunct professors from industry as recognized authorities in their fields under a new policy adopted by Stevens Board of Trustees.

•

Westinghouse Names Rural Electrification Manager

L. R. Emmert has been appointed manager of rural electrification, Westinghouse Electric Corp.

In cooperation with the industry sales departments and apparatus divisions, Mr Emmert will be responsible for the development of rural business with the Rural Electrification Administration,

L. R. EMMERT

private utilities, resale manufacturers of farm equipment and distributors.

Following graduation from Johns Hopkins University in 1936, Mr Emmert joined the Westinghouse graduate student training course. After completion of training, he spent 18 months in the Philadelphia office. He was transferred to the Washington, D. C., office in 1938 and was located there until taking his new position.

Mr Emmert succeeds N. H. Callard, who is now in Hawaii with the Hilo Electric Light Co (EW, Dec 27, p 27).

•

▶ Henry B. Sargent, president of the Central Arizona Light & Power Co. has been elected to the board of the American Institute of Foreign Trade.

Aitken Appointed Director of Development Activities

Appointment of David A. Aitken as director of development activities of the Cleveland Electric Illuminating Co has

D. A. AITKEN

been announced. Mr Aitken succeeds Robert C. Hienton, who was recently promoted to the position of industrial sales manager.

As a member of the development division, Mr Aitken has played an important role in the campaign to encourage business and industry to locate or expand in the Cleveland-Northeast Ohio area. During the war, he spent three years in the Pacific theater with various combat commands.

He is a member of the Cleveland Chamber of Commerce.

•

▶ Paul W. McCormick, formerly supervising industrial engineer, has been appointed to the position of industrial sales manager of the Union Electric Co, St. Louis, succeeding F. V. Armistead, who has resigned to establish his own consulting engineering practice.

▶ James P. King has been appointed manager of the Peabody (Mass.) Electric Light Department. He succeeds Patrick Tumulty, retired. Mr King was graduated from the University of Maine in electrical engineering in 1911. For two years he was a laboratory assistant at the Massachusetts Institute of Technology. He was occupied in educational work until 1940, when he

Steel Hard to Get?

Demand Still Exceeds Supply But . . .

. . . this is a typical view of night loading operations at a Ryerson steel-service plant. The steels specified on several orders are on their way to a loading platform for delivery the following morning. Possibly none of these orders are completely filled—however, the fact remains, we are doing our very best to serve a large group of steel users.

Unfortunately, it often seems that the particular steel *you* want is never on hand, and it is true that we are always short of some kinds and sizes. But our stocks turn over fast. A size that is out today may be in tomorrow. And in spite of current conditions, we still believe the over-all stocks at our thirteen plants are the nation's largest.

Carbon and alloy steels, hot rolled or cold finished, and stainless steel in practically every analysis and finish are in stock, ready for your call. So do not hesitate to get in touch with us —on any requirement. You'll find that every Ryerson steel man will do everything possible to help you get the steel you need, when you need it.

Joseph T. Ryerson & Son, Inc. Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

RYERSON STEEL

WITH A GREENLEE HYDRAULIC BENDER

"Big advantage of the GREENLEE Bender is that it will make any kind of offset needed in a conduit installation.

"Also the fact that this Bender is a single unit means that you can transport and set it up *right on the job* for handling various sizes of pipe."

Thus reports Koeneman Electric Co., St. Louis, Missouri, after completion of one of their recent large installations which called for countless bends in conduit from 1" to 4" sizes.

If you are not now using a GREENLEE Bender, investigate today. See how you, too, can make *accurate* offsets—all types of conduit bends—quickly, easily. Save greatly on labor and materials.

The GREENLEE Hydraulic Bender is one-man-operated. Makes smooth, precise bends in just a few minutes—in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. Compact, portable, easy to set up and operate. Write for free bulletin today. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1804 Columbia Ave., Rockford, Illinois.

Richardson & Bureau Ltd., 129 St. Peter St., Montreal, Quebec

TOOLS FOR CRAFTSMEN
GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK

Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

joined the U. S. Army Engineers staff at Boston as electrical engineer. He supervised the electrical construction at the Castle Island Port of Embarkation, Boston.

•

Gordon Appointed Director of International Sales

Lewis Gordon has been appointed director of the international sales division of Sylvania Electric Products Inc to succeed Walter A. Coogan, resigned,

L. GORDON

(EW, March 6, p 27). He will make his new headquarters at the company's international sales division office at 60 Broadway, New York.

Previously assistant to the vice-president in charge of sales, Mr Gordon has been a sales executive with Sylvania since he joined the company in 1931 as manager of New York district sales, opening the first New York City office. He has been manager of national domestic accounts in lighting sales for many years.

Garlan Morse and Frederick W. Fulle have been appointed merchandising managers of the lamp division and fixture division, respectively. Mr Morse, who has been directing sales activities for both divisions, is now devoting his entire time to merchandising policies, sales promotion and distribution problems of the lamp division. In his 12-year association with the company, he has held various positions in the manufacturing, production and sales departments, lighting division. He will maintain headquarters in Salem, Mass.

With more than 20 years' experience in the lighting field, Mr Fulle will assume the same responsibilities for the fixture division. He joined Sylvania in 1943.

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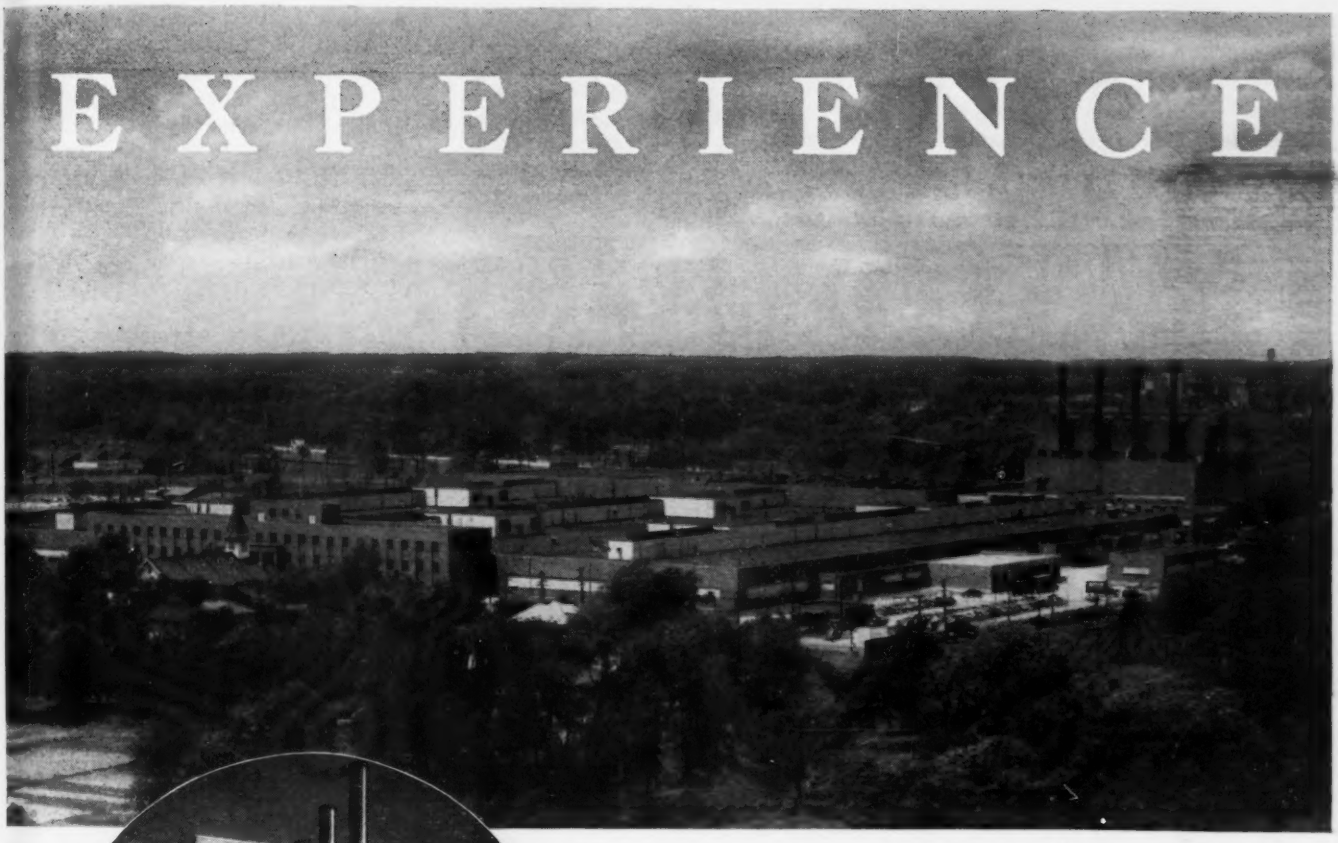
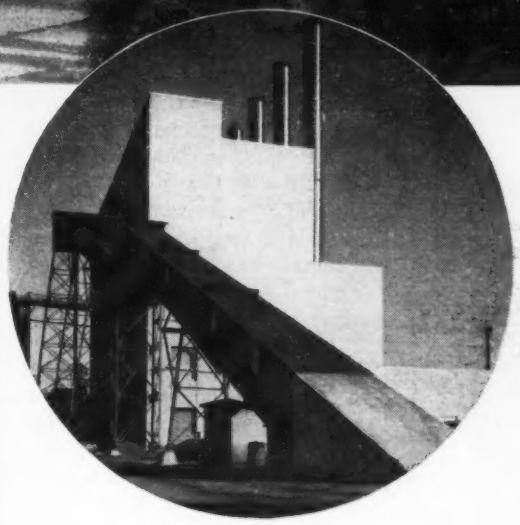
► ROY T. DUNCAN has been appointed commercial manager of the Detroit Edison Co. Mr Duncan has been identi-

EXPERIENCE





Stone & Webster Engineering Corporation designed and constructed this Plant at Fort Wayne, Indiana, for the Defense Plant Corporation. It was operated during World War II by General Electric Company.

DESIGNED and built during the War, this plant, now owned by General Electric Company, is an example of what Stone & Webster Engineering Corporation offers clients in the industrial fields.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

SORGEL AIR-COOLED TRANSFORMERS

The *Latest Development* in *Dry Type* Transformers

This is our *Principal Business*—not a side line

Over 30 Years' Experience

Liberal Design
Steel Encased
Solderless Terminals
Connection Compartment

A size and type for every purpose. ¼ to 1000 Kva. All voltages. 115 volts to 15,000 volts.

¼ KVA. Single Phase 460/230 to 115 volt.

500 Kva. 3-Phase. 4160 Volt Transformer. For Indoor Sub-Stations.

SORGEL ELECTRIC CO., 834 W. National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled transformers.

fied with the Detroit utility since 1902. EARLE L. KAVANAUGH, veteran power engineer, has been appointed new business manager in the sales department. He joined the company in 1913. EDWIN O. GEORGE has been named assistant commercial manager, sales department. Advertising and appliance merchandising have been placed under his direct responsibility. He started with the company in 1929.

▶ FRANK P. HYER, formerly manager of the Wisconsin Hydro-Electric Co, Amery, has been appointed operations manager of the Delaware Power & Light Co, Wilmington. He has been consulting engineer for the General Public Utilities system of New York since 1940.

▶ ALEX D. BAILEY, vice-president and chief operating engineer of the Commonwealth Edison Co, Chicago, has been appointed chairman of the heating plant and services division of Illinois Institute of Technology's $15,000,000 development program.

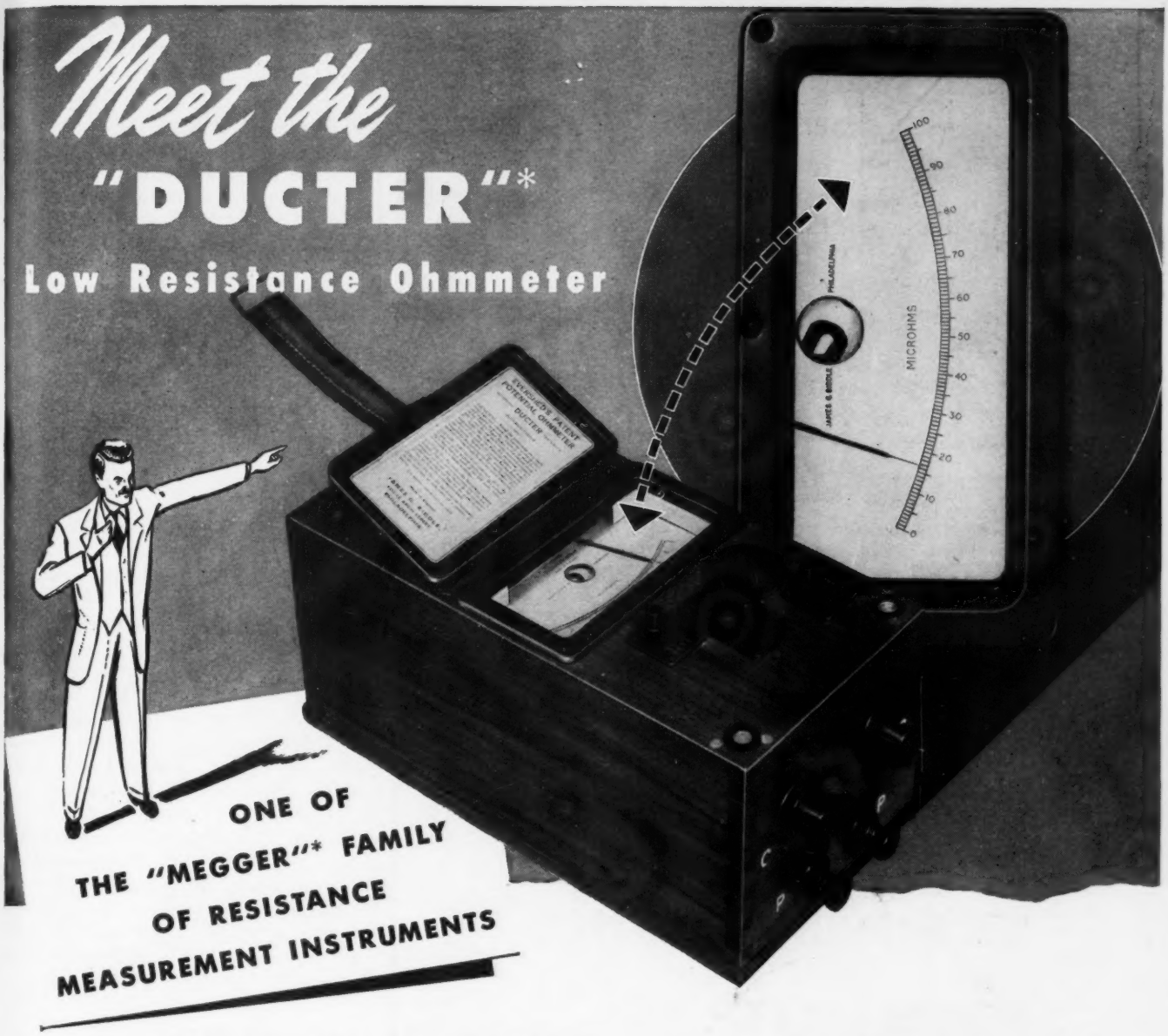
▶ JOHN H. BICKLEY, public utility consultant of Chicago, has been appointed president of the Louisville Railway Co. He succeeds Frank H. Miller, who was recently named chairman of the board of directors. In the course of his career, Mr Bickley has served on the staffs of the Pennsylvania, Maryland and Wisconsin Public Service Commissions, Federal Trade Commission and the Federal Communications Commission.

▶ JOHN W. ANDERSON has been appointed division superintendent, Philadelphia division, transmission and distribution, Philadelphia Electric Co, succeeding William Foster, retired. Mr Anderson was connected with engineering firms in West Virginia and New York before joining the Philadelphia Electric organization as an assistant electrical designer. He has had wide experience in electrical designing and construction work, having served during his connection with the company as design calculator, senior electrical designer, engineer, engineer of system planning, superintendent of engineering division, transmission and distribution department, and assistant division superintendent, Philadelphia division T&D.

▶ RAY R. ROBERSON has been appointed assistant superintendent in the light and power department of the Puget Sound Power & Light Co at Burlington, Wash., to succeed Roy Samson, retired. Previously distribution engineer at Bellingham, Wash., for ten years, he is an electrical engineer with a degree from the University of Washington. Mr Samson has been with the com-

Meet the "DUCTER"*

Low Resistance Ohmmeter



ONE OF
THE "MEGGER"* FAMILY
OF RESISTANCE
MEASUREMENT INSTRUMENTS

Rugged, accurate and direct-reading, the "Ducter" Low Resistance Ohmmeter provides an easy and practical way to test air and oil circuit breaker connections and contacts; cable joints; bus bar and line connections; armatures and series fields of generators, and motors; and low resistance transformer windings. It is also a valuable tool in quality control and for indicating relative strength and conductivity of welded joints.

One man can quickly make resistance measurements down to a millionth of an ohm—in the field! There are no calibrations or adjustments—not even for the voltage of the battery that supplies the necessary test current—and there are no calculations or charts. The resistance measurement is read directly from the position of the pointer on a scale.

The "Ducter" operates from an external battery or plug-in power supply. On every range it is compensated for outside temperature changes. As a protective feature a cut-out is included in the circuit to prevent application of too high voltage, and very high resistances or open circuits.

Various ranges of "Ducter" Ohmmeters are available to suit your requirements. A complete description, together with circuit diagrams, applications, and specifications are contained in Bulletin 24-25-W. Write for your copy TODAY and learn all about this truly remarkable instrument.

*REG. U. S. PAT. OFF.

JAMES G. BIDDLE CO.

Electrical & Scientific Instruments

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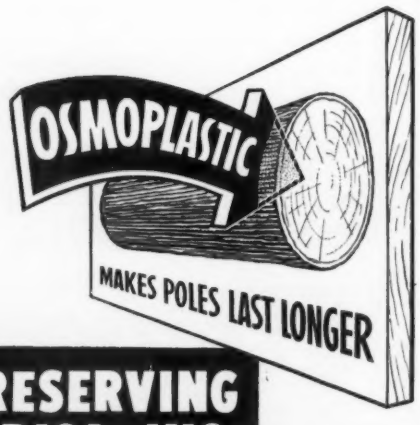
OF THE MILLIONS OF DOLLARS SAVED BY 74 LEADING UTILITIES WHO HAVE GROUND LINE TREATED THEIR STANDING POLES WITH...

OSMOPLASTIC

You too can effect tremendous savings... write for the facts



OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.
GENERAL OFFICE AND PLANT: BUFFALO 12, N. Y.

pany since 1900. He had been at Burlington as assistant superintendent since 1930.

► WALTER E. BENOIT, radio and electronics executive of the Westinghouse Electric Corp, has been granted a two-year leave of absence to serve as treasurer of Industria Electrica de Mexico in Mexico City. Industria Electrica de Mexico is a $15,500,000 company organized in 1945 by Mexican and American capital for the production of a complete line of electrical and electronics equipment.

► EUGENE D. MARTIN, associate electrical engineer with City Light at Seattle retired on March 1 after more than 42 years with the system. He became head of City Light's meter division in 1905. He invented the bridle guide drop, for running overhead wires into difficult places without setting an extra pole, and originated the idea of using pole boxes for temporary service.

► WALTER G. WETZEL has been appointed director of power and steam utilization, industrial sales department, Duquesne Light Co and Allegheny County Steam Heating Co, succeeding the late H. W. Dexter, Jr. Mr Wetzel became associated with Duquesne Light in 1922 and since 1929 has been serving as supervisor of power utilization. CHARLES M. BOARDMAN has been appointed to the latter position to succeed Mr Wetzel. He has been identified with Duquesne Light since 1925.

► JAMES WILSON has retired as manager of the field engineering section of the Allis-Chalmers Mfg Co's steam turbine department after 43 years of service. A native of England, Mr Wilson was associated with the Central Marine Engine Works, C. A. Parsons & Co, and Willans & Robinson in that country before joining A-C in 1905.

► C. B. LAY has been appointed to the newly created position of rural electrification coordinator of the Mississippi Power & Light Co, Jackson, with responsibility to work with all company divisions in the coordination of all activities affecting REA cooperatives. In his new position Mr Lay will also work closely with REA officials for better coordination of rural electrification in Mississippi. Mr Lay had previously served for several years as residential and rural supervisor for the central division. Other changes announced were the transfer of EARLE B. GUESS, for the past several years central division sales manager, to a similar position in the southern division, with headquarters in

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In addition to 40-foot-wide steel buildings, Butler plants are fabricating low-cost aluminum-covered steel buildings in 32 and 20 foot widths. These spacious, sturdy buildings feature the same truss-clear construction and straight sidewalls as the 40-foot size. They are especially suitable for small-site construction where maximum space use is essential to profitable operation.

You can adapt Butler Built Steel Buildings to almost any industrial purpose. You can quickly erect your steel building to suit interior planning, to give you maximum lighting and easy accessibility from any side.

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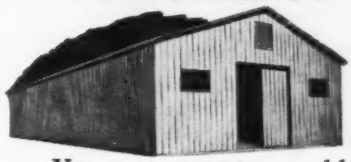

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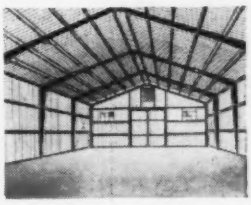

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"Essential Paper Manufacturers"

McComb. Succeeding Mr Guess as central division sales manager is H. STUART THOMAS, who until now has been serving in a similar capacity for our northwestern division. CHARLES M. BROAD, industrial sales engineer, has been appointed division sales manager for the northwestern division.

▶ HERBERT H. ROGGE, a vice-president of the Westinghouse Electric Corp, has just received from the Bureau of Ships of the U. S. Navy its certificate of commendation for services in the war. Mr Rogge is president of the Navy Industrial Association.

▶ I. J. BARBER, director of engineering for the Fostoria Pressed Steel Corp, Fostoria, Ohio, has been made a vice-president. Mr Barber has been responsible for developing the design and technique for applying the infrared equipment which Fostoria manufactures. Before joining the Fostoria organization in 1943, Mr Barber was associated with electric utility companies in New York, Atlantic City and several places in Ohio.

▶ C. RICHARD NEWPHER, production manager of the Ivanhoe division of Reliance Electric & Engineer Co, Cleveland, for the past two years, has been made division manager as well. In his enlarged responsibilities, Mr Newpher will also have charge of the plant purchased by Reliance in January from the Detroit Steel Corp. He has been with Reliance since his graduation from Case Institute of Technology in 1937.

▶ L. W. HAMPER has been named president of the Coolerator Co, Duluth, and WILLIAM J. BROWNE has been elected vice-president in charge of sales. Mr Hamper will retain his position as vice-president of Gibson Refrigerator Co, which has recently purchased the capital stock of Coolerator. He has been associated with Gibson for the past 15 years. Mr. Browne has been with the Gibson organization since 1931. He goes to Duluth from his former position as mid-western district sales manager of Gibson with headquarters in Chicago.

▶ EDWARD A. BAILY has retired from his position as a vice-president of the Consolidated Edison Co of New York, Inc. He has been in charge of administrative duties related to company activities in Brooklyn. These will be taken over by Harold C. Dean, who will retain his present position as vice-president in charge of administrative duties in Queens. Mr Baily joined the old Edison Electric Illuminating Co of Brooklyn, Inc, in 1905. When this company was merged in 1919 with the Brooklyn Edison Co, Inc, he continued with the latter organization, and subsequently

Quality Poles

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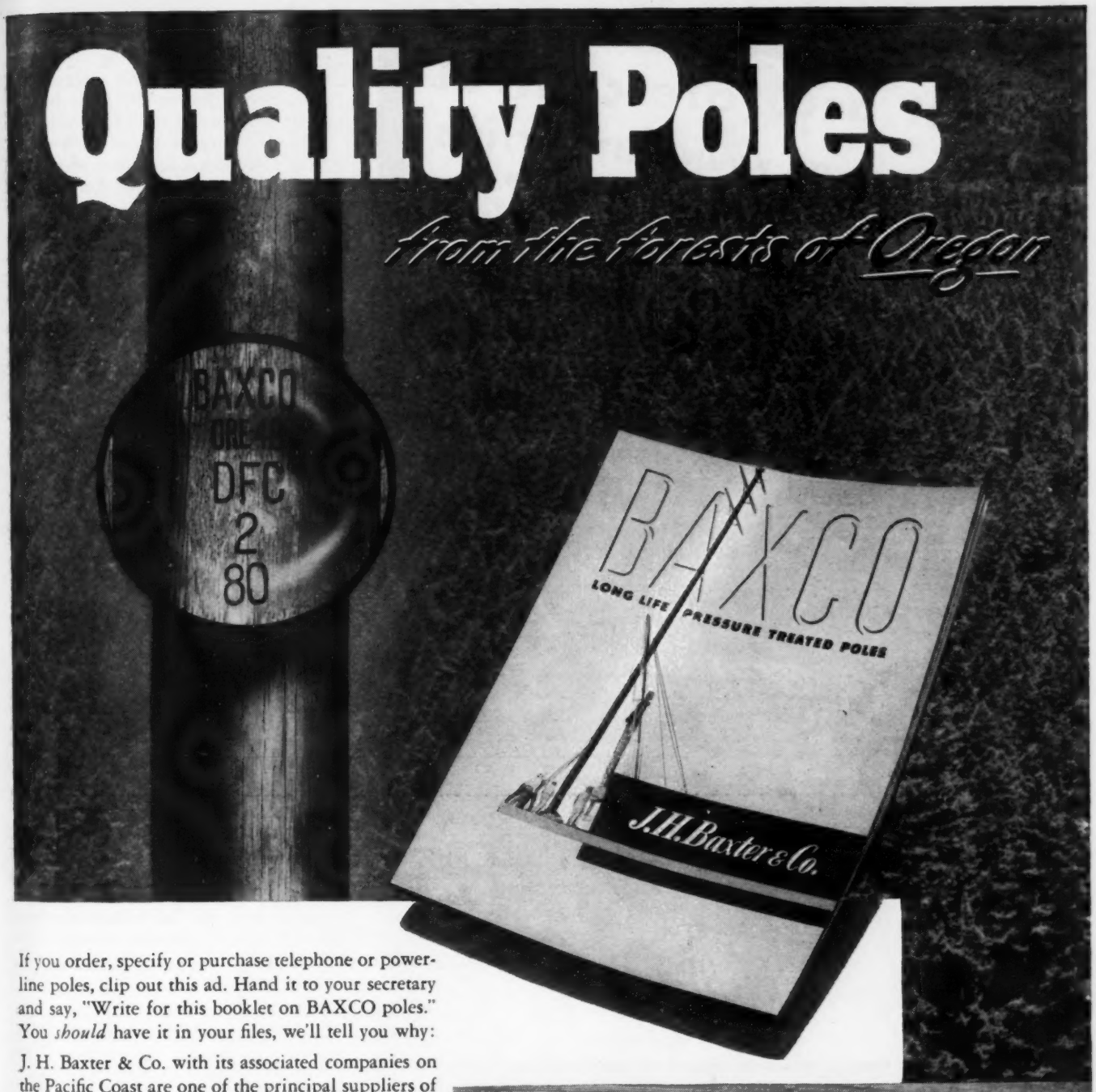

If you order, specify or purchase telephone or power-line poles, clip out this ad. Hand it to your secretary and say, "Write for this booklet on BAXCO poles." You *should* have it in your files, we'll tell you why:

J. H. Baxter & Co. with its associated companies on the Pacific Coast are one of the principal suppliers of poles in the west. As producers of BAXCO Long-Life Douglas Fir pressure-treated poles, we lay claim to be the producers of the very finest poles in the world. Just why these poles are better; why these poles are economical to buy; why these poles are available on prompt shipment is all told in the book.

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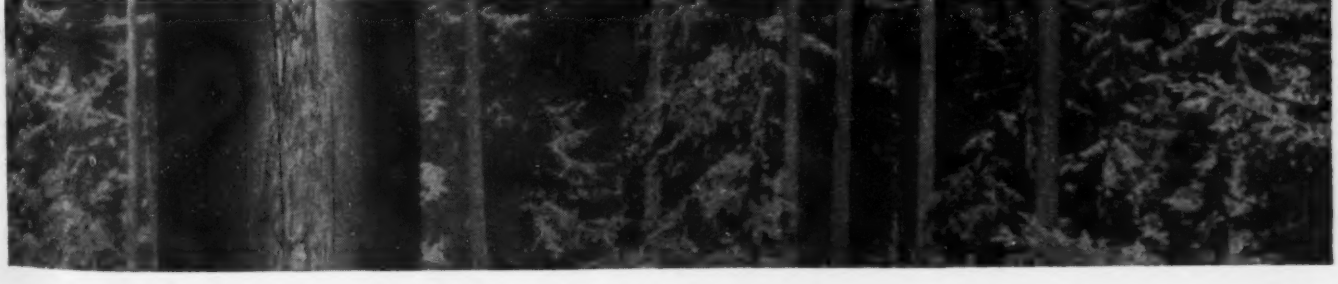

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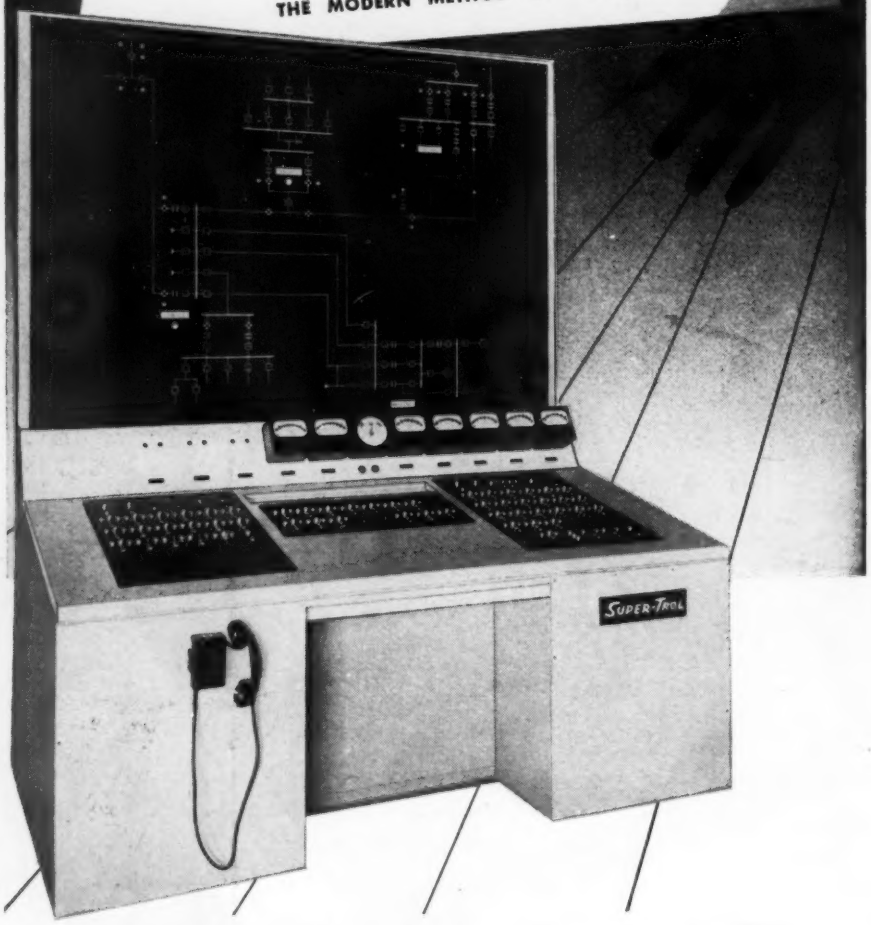

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PROVIDES FAST FINGERTIP CONTROL

Throwing a switch and pushing a button starts a generator . . . closes or opens a breaker . . . cuts out a transformer . . . meters voltage, current, or power at any point. SUPER-TROL is fast, positive, accurate, dependable.

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was elected vice-president and later executive vice-president. In 1945 when the Brooklyn utility was merged with Consolidated Edison, Mr Baily became a vice-president of the parent company with administrative duties in Brooklyn. Since 1943 he has been chairman of the finance committee of the Consolidated Edison System Companies.

▶ E. A. PRATT, consulting engineer of New York, has been appointed the representative of the International Organization for Standardization in its relations with the Economic and Social Council of the United Nations. Mr Pratt has had close working relations with the member organizations of ISO as a former member of the staff of the American Standards Association and has had wide experience in Europe, Asia, Africa and South America as representative of American companies. He maintains an office at 30 Broad St, New York.

▶ GEORGE C. MCMULLEN, who has been with the Tyson Bearing Corp, Massillon, Ohio, for 16 years, has been appointed vice-president in charge of sales. Mr. McMullen had many years of experience in the bearing industry prior to his association with Tyson. W. H. OEXLE has joined Tyson in the capacity of general sales manager. During the past 12 years, he has been with the L. S. Starrett Co of Athol, Mass., in various executive sales and merchandising capacities. HERSCHEL J. DEAL, who has been identified with Tyson Bearing since 1933, has been named vice-president in charge of the midwest territory. IVAN C. MANN, formerly manager of replacement sales, is assistant sales manager.

▶ DR H. B. OSBORN, JR, has been appointed technical director of the TOCCO division of the Ohio Crankshaft Co, Cleveland, Ohio. Mr Osborn will devote his time to exploring and developing new fields for induction heating equipment. He joined Ohio Crankshaft in 1940 as research and development engineer and in 1946 was named sales manager of the TOCCO division.

▶ RICHARD A. SULLIVAN has been appointed assistant to the general manager of the Metropolitan Transit Authority, Boston, Mass., in charge of power. He succeeds MYRON F. FREEMAN, who joined the engineering staff of the Combustion Engineering Co, Inc, New York, April 1. Mr Sullivan is an electrical engineering graduate of Harvard, class of 1936. He was electrical engineer of the Massachusetts Department of Public Utilities for five years. Since 1943 he has been gen-

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A. C. – D. C. VOLT-WATTMETERS

. . . for fast-simultaneous reading of volts and watts

These two Simpson testers are designed for simultaneous reading of volts and watts. Each has two separate 3" square meters, one for volts and one for watts. Each has built-in cord and plug for connecting to line outlet, and receptacle for connecting appliance under test. There are no leads to connect. Readings register immediately when plugs are connected. Separate, uncrowded scales make quick, accurate readings easy. Each meter has two ranges, selected by separate toggle switches with positions clearly indicated by white figures recessed in the molded bakelite case. The low power consumption of these instruments and their high efficiency result in negligible loss and error in reading.

Leatherette Carrying Case—$5.00

Model 391 (3000 watts max.)
Ranges, A.C. or D.C.
Volts: 0-130, 0-260
Watts: 0-1500, 0-3000
Size: 3" x 5⅞" x 2½"
Weight: 2 lbs.
Shipping Weight: 3 lbs.
Dealer's Net Price.....$30.00

Model 392 (5000 watts max.)
Ranges, A.C. or D.C.
Volts: 0-130, 0-260
Watts: 0-1000, 0-5000
Size: 3" x 5⅞" x 2½"
Weight: 2 lbs.
Shipping Weight: 3 lbs.
Dealer's Net Price.....$35.00

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eral manager of the Detroit Department of Street Railways. Mr Freeman was graduated from the Massachusetts Institute of Technology in 1924. For many years he was on the engineering staff of Jackson & Moreland, Boston, and Arthur L. Nelson, Engineers, also of Boston. He was made superintendent of the power department of the then Boston Elevated Railway in 1946.

▶ C. S. STACKPOLE, formerly manager of merchandising and domestic sales of Consolidated Gas Electric Light & Power Co, Baltimore, has been named vice-president and general sales manager of the Airtemp division of the Chrysler Corp.

▶ L. M. KEATING, assistant to the president in charge of distribution of the A. O. Smith Corp, Milwaukee, has been appointed executive administrator of the company's southwest district office in Houston, Tex. Mr Keating succeeds the late B. F. Bart.

▶ WILLIAM F. ANDERSON has been appointed director of sales of the Super Electric Products Corp, Jersey City. He was previously co-owner of Utility Sales Associates, manufacturers' representatives, and associated with Frigidaire Division of General Motors.

▶ GEORGE F. PLATTS has been appointed executive vice-president of Clippard Instrument Laboratory, Inc., Cincinnati. Prior to joining the Clippard organization, Mr Platts was general manager, electric products division, McQuay-Norris Mfg Co, St. Louis.

▶ CHARLES D. LIPPINCOTT has been named vice-president in charge of construction and engineering of Bradley and Williams, Inc, contractors and engineers of Syracuse, N. Y. Mr Lippincott started his career as a distribution engineer with the Philadelphia Electric Co and was for 20 years associated with the New York Power & Light Corp as distribution engineer and district electric superintendent. For the past three years he has been active in utility line contracting with Bradley and Williams.

▶ JAMES R. COBB has resigned his REA post in Washington, D. C., as assistant chief of applications and loans division to join Frigidaire Division of General Motors as manager of farm market sales, a new position created in the appliance sales department. Mr Cobb has been in charge of the REA power use program for the past three years. Prior to this he had full responsibility for valuation studies concerning the acquisition of electric utility property by

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The future of your business is closely dependent upon the future economy of your country. To a major extent, that future depends upon management of the public debt. Distribution of the debt as widely as possible among the people of the nation will result in the greatest good for all.

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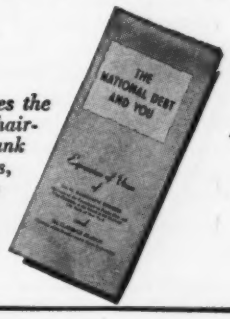
a 12-page pocket-size brochure, expresses the views of W. Randolph Burgess, Vice Chairman of the Board of the National City Bank of New York—and of Clarence Francis, Chairman of the Board, General Foods Corporation. Be sure to get your copy from the Treasury Department's State Director, Savings Bonds Division.



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REA borrowers on a nation-wide scale for three years. Mr Cobb is a member of the American Institute of Electrical Engineers and the American Society of Agricultural Engineers.

▶R. N. DREIMEN has been elected treasurer of Pacific Public Service Co and Southern Counties Gas & Electric Co. He will continue to hold his former offices as vice-president and director of both companies, with headquarters in San Francisco.

▶HOWARD E. ROBBINS, who has been serving as acting director of Reclamation Region No. 5 for seven months, has been named director of the region which comprises Texas, Oklahoma, most of New Mexico and parts of Kansas and Colorado. His headquarters are at Amarillo, Tex.

▶JAMES W. FERGUSON, superintendent of inside construction for City Light at Seattle, Wash., has retired after more than 42 years of service with the department. He first worked for City Light in 1904, as foreman of a crew putting wire and equipment in a substation, and became a permanent employee in 1906. Mr Ferguson supervised construction of many City Light substations.

▶DR HALDON A. LEEDY, chairman of physics research at Armour Research Foundation of Illinois Institute of Technology, has been named acting director of the foundation. Dr. Leedy succeeds Dr Jesse E. Hobson, who has resigned to accept the directorship of the Stanford Research Institute. At the research foundation, he has engaged in various fields of acoustical research. Dr Leedy is a senior member of the Institute of Radio Engineers and a member of AIEE.

▶B. S. Moss, formerly rural engineer for the Columbus division of the Georgia Power Co, has been named agricultural agent for the company, with headquarters in Atlanta.

OBITUARY

▶JOHN W. CHIPPERFIELD, vice-president of Ferranti Electric, Ltd, died suddenly on Mar 16 at his home in Toronto. Born in England, Mr Chipperfield came to Canada in 1911. He was associated with Col George C. Royce in the formation of the Ferranti Electric Co of Canada. After the reorganization of the company, which became known as Ferranti Electric, Ltd, Mr Chipperfield became chief engineer. Subsequently he was appointed

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EBASCO engineers will develop several alternative plans with comparisons of investments, investment costs, operating costs, evaluated service and other factors. You get a complete report on which management can act with assurance. It advises you on *when*, *what* and *where* to build. *Write for a booklet describing* EBASCO *services and facilities.*

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assistant general manager and later vice-president. During World War II, he was in charge of constructing and equiping a new building for the production of intricate instruments and equipment for the control of anti-aircraft guns and for naval equipment. Mr Chipperfield was a member of the American Institute of Electrical Engineers and of the Association of Professional Engineers of Ontario.

▶ KENNETH N. COOK, assistant sales manager of the Rollway Bearing Co, Inc, Syracuse, N. Y., died suddenly on Mar 5. He had been with the Rollway organization since 1927.

▶ HARRY W. CUSTER, district manager of the Illinois Power Co at Monmouth, died on Mar 24 in that city after a short illness. Mr Custer had been district manager at Monmouth since 1924 and had previously been identified with the company at Galesburg and Abingdon. He was born in Fairchance, Pa., 70 years ago.

▶ PHILIP N. WENZ, secretary of the Foster-Wheeler Corp, New York, died suddenly on Mar 19 at the age of 58. Mr Wenz was born near Elizabeth, N. J. He became identified with the Wheeler Condenser & Engineering Co in 1920. Elected assistant secretary in 1925, he was named to the same position two years later with the Foster-Wheeler Co, when the new group was formed. It was in 1935 that he was made secretary. He was also secretary of Foster-Wheeler, Ltd., of Canada.

▶ JOHN P. ELTON, retired vice-president and treasurer of the American Brass Co, Waterbury, Conn., died on Mar 7 in Pinehurst, N. C., where he was vacationing. He was 82 years old. Although retired from the American Brass Co, which he had served as treasurer for nearly 25 years, Mr Elton was a director of the Scoville Manufacturing Co and several other Connecticut industrial corporations, including Landers, Frary & Clark.

▶ LEONARD WILSON, consulting electrical engineer for many Utah corporations, died on Mar 15 in a San Diego (Calif.) hospital. He began his career with General Electric at Athol, Mass., and Schenectady, N. Y. In 1907 Mr. Wilson went to Salt Lake City as manager of the company's office there. He resigned in 1909 and the following year became associated with Knight Investment Co, Provo, Utah, for which organization he designed three power plants. He had been consultant for the Utah Public Utilities Commission and several industrial companies.

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Babcock & Wilcox Installs 2,000,000-V X-Ray to Examine Welds in Boilers

The Babcock & Wilcox Co has installed a 2,000,000-v x-ray machine to examine the welds in high-pressure, high-temperature boiler drums. The machine is housed in a new building at the Barberton (Ohio) Works.

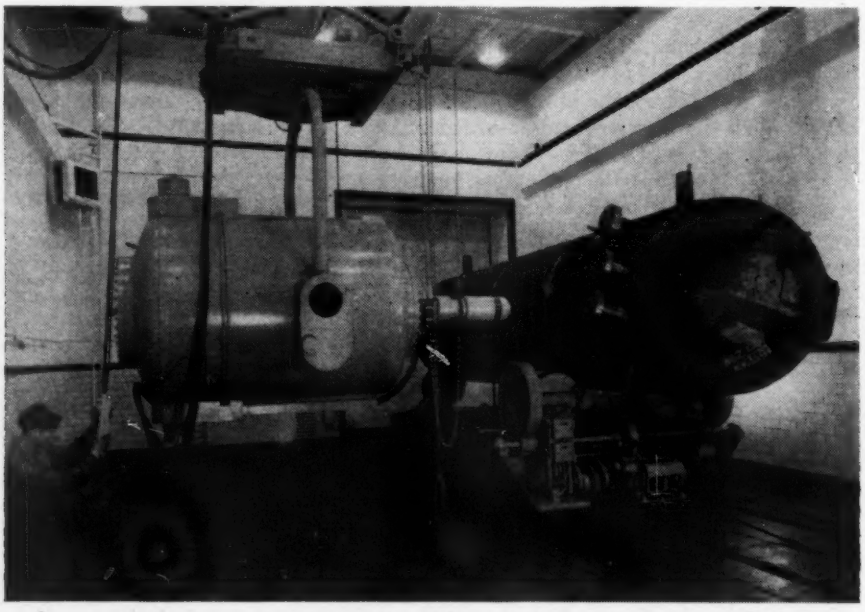
The machine speeds up production of large pressure vessels and boiler drums. Exposure time of a 5½-in. plate is only six minutes when the film distance is 6 ft. Small laminations which have not been seen heretofore on radiographs of heavy plate are more easily found. A sensitivity to variations of under 2% of the weld thickness is obtained.

B&W now has 13 machines ranging from 200,000 to 2,000,000 v. Every inch of the main welds in pressure vessels is x-rayed. In 1940, the company installed a 1,000,000-v machine. This was satisfactory for the examination of welds up to 4½ in. However, in recent years, welded boiler drums which are 5 to 6 in. thick and operate up to 2,500 psi with steam outlet temperatures up to 1,050 F have become common. With the 1,000,000-v machine, testing time for drums 5½-in thick at 6 ft was about two hours.

The new 70 by 30-ft building housing the 2,000,000-v machine was designed to provide complete protections against x-rays. The concrete walls are 32 in. thick at the bottom, decreasing to 9 in. at the top. Access to the control room is through a concrete maze with walls 40 in. thick. The entire layout was planned to assure safety.

Pressure vessels to be tested enter the building on power driven drum turners from the drum shop with which the new building is directly connected. The 120-ton door of the x-ray room moves horizontally on an overhead track. The floor along the doorway is raised to fit into an upward curve in the bottom of the door so that no x-rays can pass under the door when it is closed.

Functional design and a bright color scheme are used in the new building. Interior walls are lined to a height of 6 ft with light buff colored tile trimmed with red. The floor is painted red, and the upper walls, the machine, and the drum turner are a light cream.



NEW 2,000,000-V x-ray machine of the Babcock & Wilcox Co at Barberton, Ohio. Transformer and tube are in large tank mounted on trunnions and supported by a crane. The worker controls the position of the 6,000-lb machine in relation to the pressure vessel to be examined from control panel in his hand

Alcoa Uses Aluminum in New Davenport Plant

The greatest single application of aluminum ever achieved in the building trades is the claim made by the Aluminum Co of America for its sheet and plate rolling mill which is nearing completion at Davenport, Iowa. The use of over 6,250,000 lb of aluminum at the project no doubt justifies the claim.

More than three miles of aluminum-insulated wall panels, weighing over a million pounds, compose the bulk of the exterior surface of the huge project. The remainder consists of nearly 500,000 sq ft of aluminum window sash, and part of the plant's 400-odd aluminum doors. The aluminum roof covers 47 acres and contains nearly 3,000,000 lb of the metal. There are 227 all-aluminum roof ventilators.

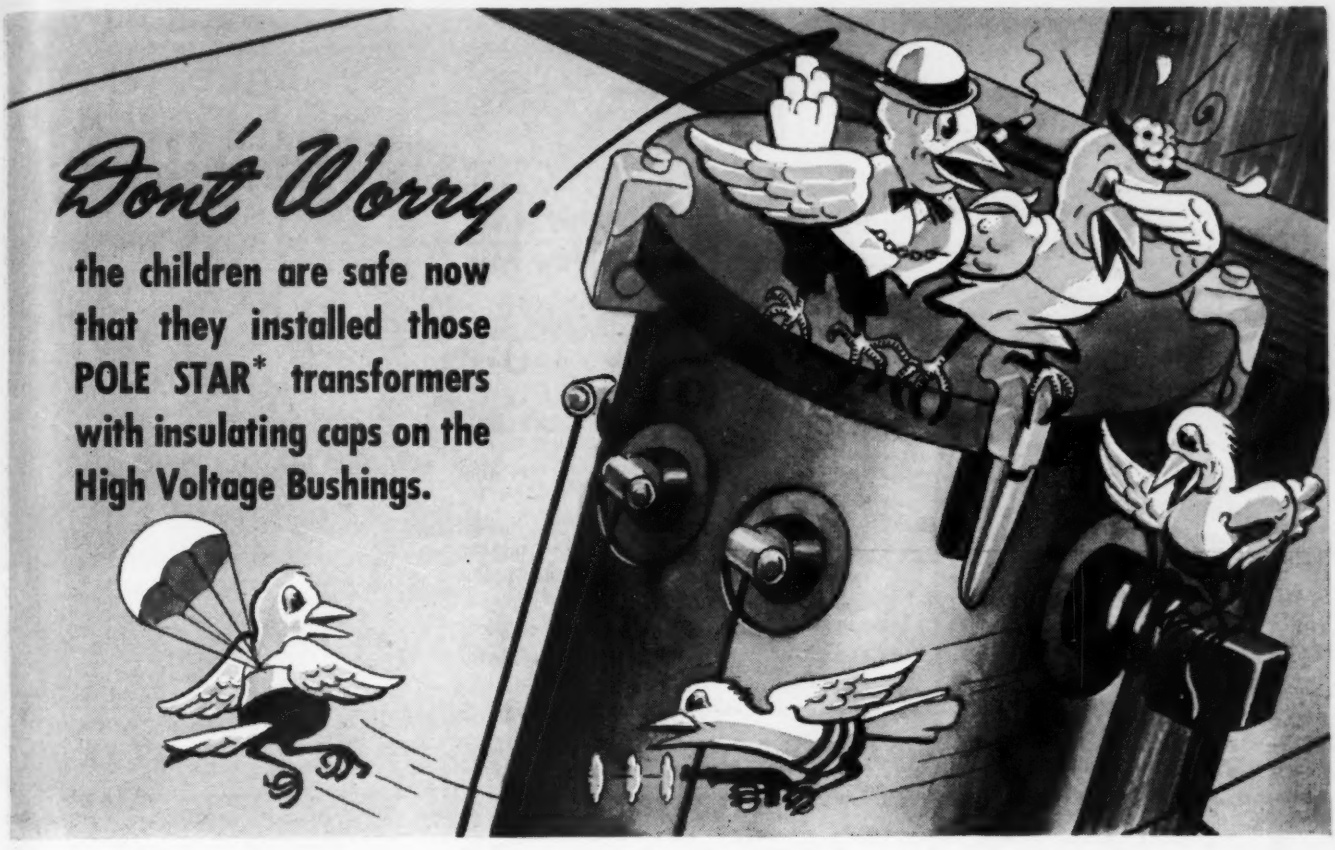
Surrounding the grounds and buildings is the longest aluminum chain-link fence ever constructed. It is eight feet high and four miles long and contains nearly 2,000,000 ft of aluminum wire. Three strands of aluminum barbed wire top the fence.

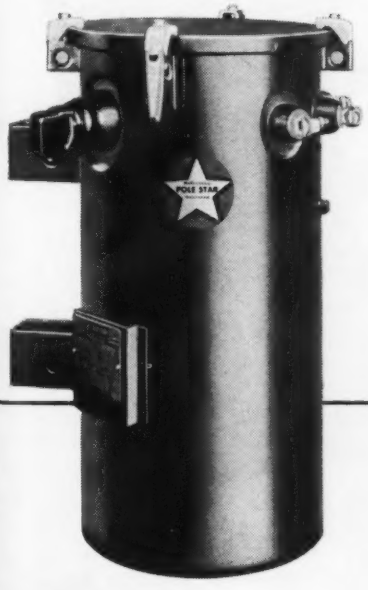
Nearly a million pounds of aluminum cable, bus conductors, and conduit were used. Included were 1,340 miles of insulated aluminum wire and cable for the plant's power and light requirements, and 98 miles of aluminum conduit ranging in size from 0.5 to 5.0 inches in diameter. The lighting system consists of 6,800 aluminum lighting fixtures, thousands of them with aluminum reflectors. Six high-voltage power line transmission towers on the grounds are built with aluminum alloy structural shapes. Similar construction is used for the switch tower where power for the rolling mill enters the site.

Some structural steel, 25,000 tons, was used in the framework. It is painted with three carloads of aluminum paint.

Merge Chicago Offices

I-T-E Circuit Breaker Co and Railway & Industrial Engineering Co have consolidated their Chicago sales organizations and opened a direct factory office in the Bankers' Bldg, 105 W. Adams St. Personnel of the new office includes E. A. Schmidt, district man-


Don't Worry.
the children are safe now that they installed those POLE STAR* transformers with insulating caps on the High Voltage Bushings.



SHOULD the birds get playful and decide to use the high voltage bushings as a diving board, have no fear for the safety of the transformer, or for that matter, the safety of the birds! Our feathered friends cannot make contact with the live parts of the bushings, because no live parts are exposed.

Linemen like the sturdy, well designed POLE STAR insulating caps because they cover sharp points and edges on bushing terminals that may catch their clothes should they happen to come too close to the bushings.

Insulating caps are attached to the bushings and swing in and out of position on non-corroding spring wire hinges. Caps are self-supporting above the terminals leaving connectors completely exposed so the linemen can see the connections they are making. After connections are made with a standard wrench, the caps are closed by hand pressure which locks them in place to completely cover the bushing terminals.

Embodying a new wound core design with an inherent low exciting current, POLE STAR Transformers are made in sizes 25 Kva and below, 14400 volts and below, single phase, 60 cycles, OISC, conforming to EEI-NEMA Standards, Second Report (Revised).

To Remove:
Grasp insulating cap.
(Note streamlined appearance of cap.)

Rotate out and up.

Rest cap on top of insulator and make proper connection. Connection is fully visible and is made with a standard wrench.

To Replace Cap: Rotate downward and push back into position.

*P. S.
let the POLE STAR be your guide...
Product Of Long Experience
Safe Thrifty And Reliable

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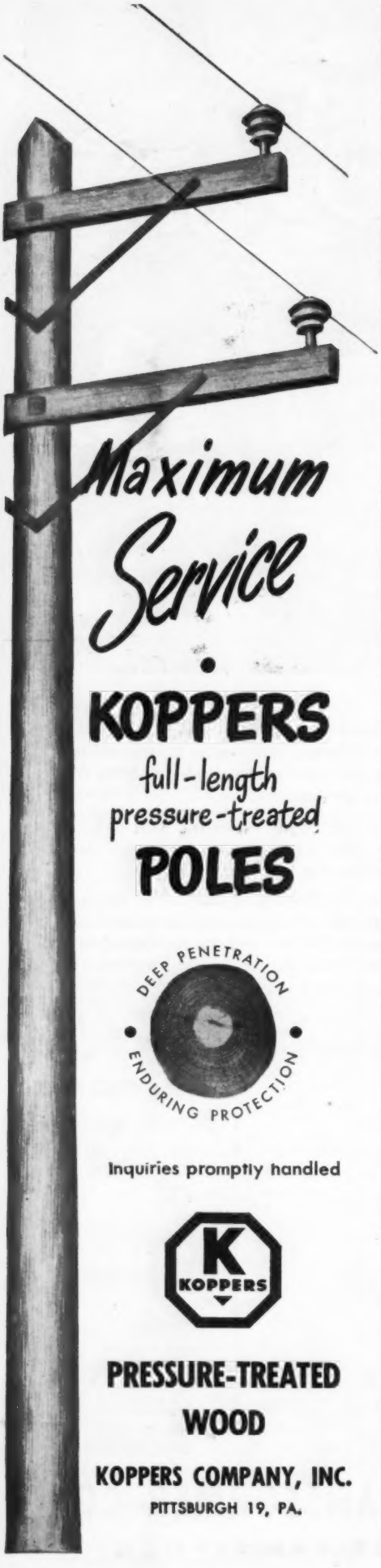
Pennsylvania TRANSFORMER CO.
PITTSBURGH 12, PENNSYLVANIA



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ager; C. A. Nordquist, assistant district manager, and M. L. Stoughton, Thomas Donaldson, N. M. Osborne, W. C. Briggs, and N. S. Spencer, application engineers.

•

Permanente Metals to Start Production in New Mill

Permanente Metals Corp will start production in April, 1949 on aluminum wire and cable in a new rod and bar mill in Spokane, Wash., the company has announced.

Contracts for the construction of machinery for the mill were awarded to the United Engineering & Foundry Co of Pittsburgh. The plant will be the second major aluminum fabricating facility in the Northwest, both being operated by Permanente.

The new unit will be capable of processing over 120,000,000 lbs of metal annually.

•

Sylvania Acquires Interest in Thorn Electrical Co

Sylvania Electric Products Inc, New York, has acquired a substantial minority interest in Thorn Electrical Industries Ltd of London, England. Thorn Electrical produces incandescent lamps, fluorescent lamps, lighting fixtures, electrical appliances and radio sets.

Sylvania's interest in the British electrical company has been acquired through a general agreement between the companies which includes cross-licensing under patents in the lighting field, reciprocal technical aid, and exchange of machinery, equipment, component parts and materials.

•

Improves Safety Record

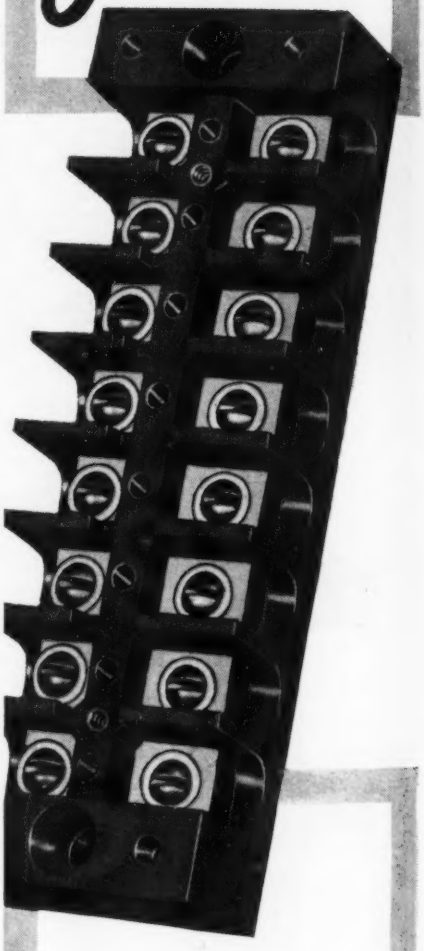
Marked improvement in the safety record of plant employees of the Formica Insulation Co, Cincinnati, is disclosed in a five-year comparison survey completed by John L. Shear, safety director of the company. The plant safety record registered an improvement of 38% in accident frequency and a betterment of 55% in the severity rate for the year 1947 compared to 1946.

•

British Cleaner Available

A British vacuum cleaning company is invading the United States. The company is Vactric, Inc. The new home appliance will sell for $99.50. In addition to conventional attachments for vacuuming away surface dust and

Bakelite TERMINAL BLOCKS by Insulation



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How to ELIMINATE MAINTENANCE on Switchboard Bus Bars

The best way to eliminate bus bar maintenance is to join the bars by a method that makes maintenance-free joints—joints that can't come loose and won't oxidize or corrode. That method is—

SIL-FOS BRAZING

In addition, SIL-FOS joints equal the bus metal in electrical conductivity and in ability to withstand vibration, shock and temperature changes. The low-working temperature and extreme fluidity of SIL-FOS make brazing fast and economical—particularly where the alloy is preplaced as shown below.

BULLETIN 12-A *gives you complete SIL-FOS details. Copy on request.*

In the job above, bars were assembled in fixture with SIL-FOS sheet cut to fit and preplaced at each joint. Application of heat joins the bars—and, if need be, will "unjoin" them just as readily.

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dirt, the British cleaner includes automatic applicators using germicidal, insecticidal, deodorizing, and dry-shampooing products in liquid form.

•

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Hotpoint Inc, New York, has appointed E. P. Toal New England-New York district manager.

Locke Incorporated, Baltimore, has appointed Charles Bowling manager of the Nashville local office and R. A. Murphy as sales engineer in the Minneapolis office.

Telechron Inc, Ashland, Mass., has appointed Allen W. Rork, district manager of the Pittsburgh district sales office and Richard D. Tyler district manager of the Philadelphia office. Mr Rork was formerly on Telechron's Chicago office staff covering the Minneapolis area. Formerly district manager at Pittsburgh, Mr Tyler in his new assignment succeeds R. J. Buckley, who has been made manager of standard clock sales at the home office in Ashland.

Oliver Iron & Steel Corp, Pittsburgh, has named C. R. Dudley sales representative of the pole line hardware division with headquarters in Atlanta, Ga. He will cover Georgia and Florida and report to the Birmingham office. K. D. Busbee has been made representative in the pole line hardware sales department with headquarters in New Orleans, La. He will be responsible for sales in the New Orleans territory which includes Louisiana, Mississippi and sections of Arkansas and Texas, and will report to the Birmingham office.

Radio Corp of America, RCA Victor Division, has appointed J. R. Little as eastern region manager with offices at 36 West 49th St, New York. Mr Little has been manager of distributed products of the engineering products department since he joined the company two years ago and recently has been acting region manager. In his new position, he will supervise all activities of the RCA Victor Division in the eastern region, which extends from New England through the District of Columbia.

•

GE Lamp Unit Buys Plant

The lamp department of the General Electric Co has purchased the former American Magnesium Corp plant at 1099 Ivanhoe Road, Cleveland. The property, consisting of six acres of land, a 53,000 sq ft factory building and 15,000 sq ft office building, both one-story structures, will become headquarters of the lamp department's chemical products division, now located at Nela Park. Transfer of the chemical products division, headed by W. P. Cartun, is scheduled to begin in early summer and to be completed by fall.

To help you keep machines "in step"

POWER SYSTEM STABILITY

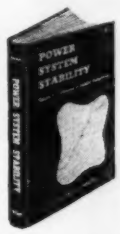
Volume I

By EDWARD W. KIMBARK
Professor of Electrical Engineering
Northwestern University

This new book tackles two important phases of the problem of increasing the reliability of electric power service by keeping instability at a minimum. First, it presents methods of analysis and calculation necessary to determine whether a given system is stable when subjected to a specified disturbance. Second, it examines the effect of various factors on stability and considers measures for improving stability. Emphasis throughout the book is placed on transient stability.

•

Contents include: The Stability Problem; The Swing Equation and its Solution; Solution of Networks; The Equal-Area Criterion for Stability; Further Consideration of the Two-Machine System; Solution of Faulted Three-Phase Networks; Typical Stability Studies.



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Weaver Hot Line Clamps are of sturdy, long lasting construction. They are designed to prevent loosening through vibration and to provide positive, low-resistance tap connections.

Weaver Hot Line Clamps cost less than other clamps of comparable quality in that two types of Weaver Clamps—Type 1-WS and Type WSB-C—will fill 90% of your requirements.

Also they are more economical to stock because fewer sizes of Weaver Clamps are needed to take care of every requirement.

TYPE 1-WS

—cu to cu

For line wire sizes from No. 6 solid to 4/0 stranded, and tap wire sizes from No. 6 to 2/0 stranded copper. Also available as Type 1-WSC cadmium plated bronze, all-purpose clamp.

TYPE WSB-C

—cadmium plated bronze, all purpose clamp for al to al or al to cu

For line wire sizes from No. 8 A.C.S.R. to 1/0 A.C.S.R. with armor or 336,400 CM A.C.S.R. without armor, and tap wire sizes from No. 8 A.C.S.R. to 1/0 A.C.S.R. or No. 6 solid to 2/0 stranded copper. Also available without cadmium plating as Type WSB for cu to cu only.

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Recent Rate Changes

Iowa Public Service Co, Sioux City, has announced an increase in electric rates that will affect nearly 200 Iowa communities. The increases will be effective with April meter readings. In most towns, the increase will not apply to the first 50 kwhr used by residential customers and the first 75 kwhr for commercial use, H. M. Smith, vice-president, stated. Bills of those residential customers using more than 50 kwhr will increase in a range of 1 to 25 cents a month. For commercial customers in a number of towns, a small increase will be made which will bring such rates in line in all towns. The extra cost of those using 75 kwhr or more will range from 1 to 90 cents a month. The over-all increase will be 2%, Mr Smith said.

Gulf Power Co will reduce residential and commercial rates with bills dated on and after May 1, according to L. C. Parks, general manager. The new rates will affect more than 40,000 customers and result in a total saving of $300,000 a year. The new residential rate is as follows: 16 kwhr for $1 minimum; 32 kwhr at 4.5 cents per kwhr; 52 kwhr at 3 cents per kwhr; 120 kwhr at 2 cents per kwhr; 620 kwhr at 1.25 cents per kwhr; all over 840 kwhr at one cent per kwhr. For heating loads in excess of 3 kw and motor loads in excess of 3 hp there will be an additional charge of $1 per kw and 75 cents per hp for such excess loads. The new commercial rate is as follows: first 80 kwhr per kw of capacity requirements: 20 kwhr for $1 minimum; 180 kwhr at 5 cents per kwhr; 800 kwhr at 4 cents per kwhr; over 1,000 kwhr at 3.5 cents per kwhr. Next 100 kwhr per kw of capacity requirements: 2 cents per kwhr; all over 180 kwhr per kw of capacity one cent per kwhr.

Utah Power & Light Co's application to reduce rates to two classes of consumers —irrigation pumpers and "resale users" of more than 44,000 volts—has been approved by the State Public Service Commission. Some 85 pumping users will benefit by the reductions, which will lower average power costs from the current 83 cents to 78 cents. Municipal corporations taking service at 44,000 or more volts for reselling will receive immediate reductions amounting to $9,600.

Pacific Power & Light Co's irrigation rate revisions, which will reduce power bills of eastern Washington farmers an estimated $25,000 annually have been approved by Andrew J. Zimmerman, Washington state public utilities director. The new rates, to provide for the special requirements of irrigation, will be available to farmers between March 1 and October 31 each year.

Southern Indiana Power Co, Rushville, has been granted permission by the State Public Service Commission to increase its minimum monthly rates from $1 to $2, effective March 1, for residential and commercial electric users.

Eastern Shore Public Service Co has asked the Maryland Public Service Commission for an increase in electric rates that would amount to $82,000 a year. The increase would be based on fuel costs to the company and would rise or fall with

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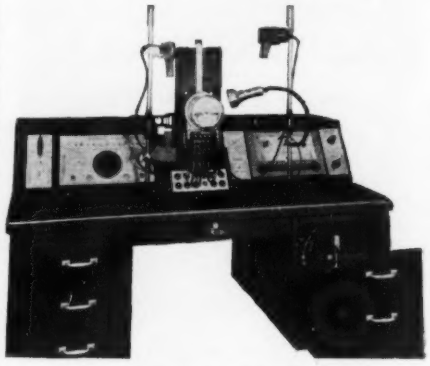

FORM "FRSS"

Combined STROBOSCOPIC and Photo-Electric Equipment for watthour meter testing

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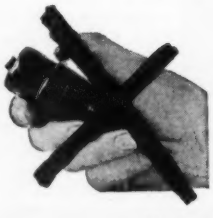
Testing with the strobo light beam permits adjusting the meter *while disc is in motion.* Both the FRSS and FRSD Tables have this Equipment.

Form "FRSD"



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19 New Park Ave. Hartford, Connecticut

for full information

coal prices. The utility gave steadily increasing operating costs over the past year as the reason for its request. Eastern Shore stated that of the $82,000 in expected additional annual revenue, $33,500 would have to be paid out in federal and state taxes, leaving it $48,400.

Omaha Public Power District directors have announced a 10% reduction in electric rates, effective April 1. The rate reduction will amount to $1,250,000 a year. All classes of users will share in the savings. The total is 10% of the PPD's 1947 revenues. More than $400,000 of the present reduction will be applied on residential bills. There are 64,000 residential users. There will be a cut of $500,000 for business and industrial users. A new, special lower rate of 2 cents a kwhr has been set for all public and parochial schools, public buildings and charitable institutions in the district. Towns, farms and businesses in the district outside of Omaha will share the reduction on the same basis as users in the city. They will really receive two cuts. Their rates will be lowered to the present Omaha level and then to the projected level.

•

GE Forms 6 Units in Small, Medium Motor Divisions

Organization of six divisions in the small and medium motor divisions of the General Electric Co has been announced by W. H. Henry, manager of the divisions. They include administrative, general sales, product sales, product engineering, product manufacturing and accounting.

Personnel involved are: D. E. Moorhead named assistant to the manager of the divisions, assigned to engineering and manufacturing work; O. F. Vea assistant to the manager, assigned to sales work; H. W. Bennett, manager gear motor sales divisions; C. W. Falls, manager commercial engineering division, general sales divisions; J. T. Farrell, manager d-c motor sales division, product sales divisions; Elliott Harrington, manager induction motor sales division, product sales divisions; C. C. Hutton accountant, Schenectady induction motor accounting division; M. E. Rexford, manager standards and pricing division, general sales divisions.

•

Motor Company Formed

The incorporation of the New Electric Motor Co, with headquarters at 200 Troup St, Rochester, N. Y., has been announced by Sidney Gilbert, president. This company, a subsidiary of the Norry Electric Corp in Rochester, N. Y., is operating as a special unit of this corporation.

Announcement was also made of the removal of the ABC Electric Motor Co of Rochester, retail sales division of the Norry Electric Corp, from its present location to 204 Troup St.

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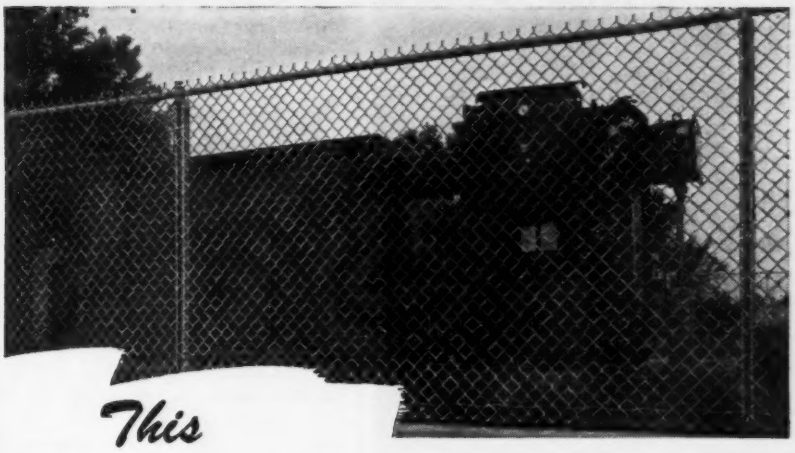

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Insulating materials that assure long life and trouble-free service when used in your electrical equipment, are available from NATIONAL.

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RAPID delivery from large stocks.

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Service Connectors

Sherman Connectors are made from silicon bronze averaging more than 90,000 lb. tensile strength per square inch. Threads on the body are not pressed or stamped, but are die cut and checked with precision gauges to mate perfectly with the tapped threads in the nut.

All connectors have full hex heads and nuts are extra thick. The solid, reinforced spacers provide maximum bearing surface on the wire and nut. Extra long pilot, for easy assembly.

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ELECTRICAL FITTINGS

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona and California—Bureau Reclamation, Dpt. Interior, Bldg 1A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Phoenix, Maricopa, Heaton, Tucson, Coolidge, Yuma, Kingman (Louise), and Prescott, Arizona, and Earp and Blythe, Calif., carrier-current telephone transmitter-receiver sets for Parker Power plant, Phoenix, E. D. No. 5, Tucson, Coolidge, Gila, Drop No. 4 Substations; coaxial, carrier-frequency cable for Parker and Davis Power plants, Phoenix, Maricopa, Tucson, Coolidge, Blythe, Gila Substations; carrier-current bypass for Coolidge, Phoenix and Tucson Substations; carrier-current telephone transmitter-receiver set and carrier-current bypass for Pilot Knob Switching Station E. D. No. 2, E. D. No. 4, E. D. No. 5, Maricopa and Blythe Substations; carrier-current line tuning unit for Cochise and Phoenix Substations; coupling capacitors at for Davis Parker, Blythe, Phoenix, Gila, Maricopa, E. D. No. 2, E. D. No. 5, E. D. No. 4, Coolidge, Tucson and Prescott Substations; carrier-current line traps, double-frequency, for Davis, Parker, Blythe, Gila, Maricopa, E. D. No. 2, D. D. No. 4, E. D. No. 5, Coolidge, Tucson, Cochise Substations, for Davis Dam and Parker Dam Power Sys., Davis Dam Proj., Arizona-Nevada, Spec. No. 2176, W. R. Young, ch. engr.

Conn., Devon—Connecticut Light & Power Co., 36 Pearl St., Hartford, installing two 60,000 kw. turbo-generators, Devon Power Station. **$4,000,000.**

Fla., Chattahoochee—State, Male Ward Bldg., dining rooms and sub-station power plant at Florida State Hospital. Over $250,000. Plans deposit $25. G. C. Fulton, State Archt. and Assoc., Tallahassee, engrs. and archts.

Fla., Pensacola—Naval Air Station, c/o Officer-in-Charge-of-Construction, Pensacola, imprv. steam and electrical distr. sys. Plans deposit $10.

Fla., Tallahassee—City, electric power plant. **$4,000,000.**

Kansas—Smoky Hill Electric Co-operative Assoc., Ellsworth, 360 mi. rural distr. lines, sys. imprvs., Ellsworth Co. **$540,000.**

Mississippi — Twin County Electric Power Assoc., Hollandale, 177 mi. rural distr. lines, sys. imprvs., completing previously approved construction, Washington Co. **$775,000.**

North Dakota—Minnkota Power Co-operative, Grand Forks, generating and transmission co-operative, and 132 mi. rural distr. lines, Grand Forks Co. **$820,000.**

Pa., New Castle—Pennsylvania Power Co., New Castle, plant and line addns. **$2,097,200.**

Tennessee—U. S. Eng., P. O. Box 1070, Nashville, Zone 1, main power transformers and reactors for Center Hill Power Plant. Inv. Serial No. W-40-058-eng-48-59.

Texas—U. S. Eng., 606 Santa Fe Bldg., Galveston, two 27,500 hp. hydraulic turbines, furnishing, installing, etc. Inv. No. W-41-243-eng-48-229.

Utah, Cedar City—Columbia Iron Mining Co., Cedar City, 750 kw. diesel driven power plant for iron mining operations at iron mines, near here. **$400,000.**

Washington—State Hy. Dpt., C. B. Shain, dir., Olympia, rein.-con. pre-cast tubes below surface of Puget Sound to carry traffic between Seattle and Olympic peninsula. **$40,000,000.**

Low Bidders & Contracts Awarded

Colo., Denver—Pub. Service Co. of Colo., 15 and Champa Sts., design and construction 10 story steam power plant known as Arapahoe Plant, 50 acre plot,

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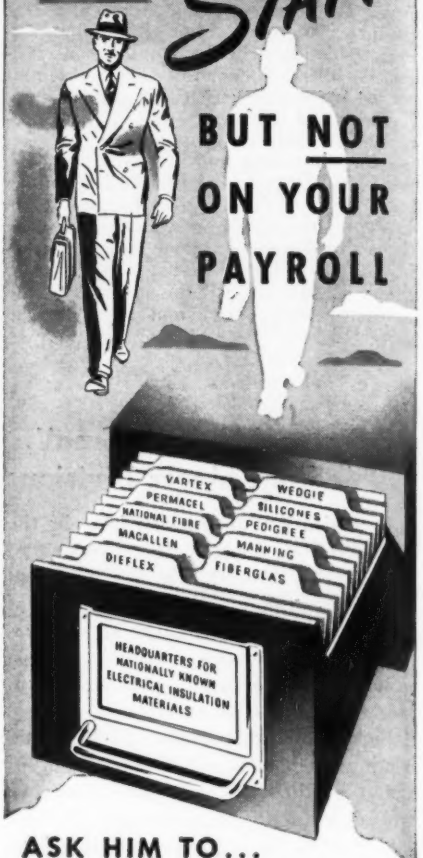

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2. Familiarize you with their proper application.
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W. Vassar Ave. and S. Navajo St., to Electric Bond & Share Co., 2 Rector St., New York, N. Y. Est. **$14,350,000.**

Fla., Lakeland—City, c/o C. Larsen, mgr. City Light & Water Plants, Lakeland, electric power plant, own forces. **$1,800,000.**

Ill., Stickney — Commonwealth Edison Co., Clark and Adams Sts., Chicago, general contract 1 story, 1,500,000 kw. brick generating plant, to John Griffiths & Son Co., 228 N. La Salle St., Chicago. Total est. **$35,000,000** incl. equip. Naess & Murphy, 80 E. Jackson Blvd., Chicago, archts.

Kan., Clay Center—City, power plant structures and power piping, to L. M. Markcum, 608 E. Yerby St., Marshall, Mo. **$95,984.** Bids 3/9.

Md., Baltimore—Consolidated Gas, Electric Light & Power Co., Lexington Bldg., 2 story, 78 x 121 x 143 ft. steel, concrete power plant, 2101-2121 Kloman St., Westport, Baltimore, to Arundel Corp., Pier 2, Pratt St. Approx. **$1,000,000.**

Missouri — Pemiscot-Dunklin Electric Co-operative, Hayti, 47 mi. rural distr. lines, various short taps, service connections, Dunklin and Pemiscot Counties, own forces. Est. **$130,000.** Rural Line Engineers, 2 Central Ave., Clayton, St. Louis, Zone 5, engrs.

O., Logan—General Electric Co., River Rd., Schenectady, N. Y., 320 x 500 ft. factory on 15 acre tract, 1 mi. north on State Route 75, to H. K. Ferguson Co., Hanna Bldg., Cleveland. Est. **$2,000,000.**

Tex., Corpus Christi—Central Power & Light Co., Corpus Christi, rein.-con. substructure for power plant to Lee Aiken, Corpus Christi. **$115,000.** J. T. Persons, c/o owner, ch. engr.

Wis., Manitowoc — Manitowoc Public Utilities, 817 Franklin St., power plant addns., imprvs., 2 and 3 story, 80 x 108 ft. turbine room, to Hamann Constr. Co., Manitowoc. **$155,536:** 1 story, 24 x 50 ft. intake well exten. bldg., to Kasper Constr. Co., Manitowoc, **$38,142.** Bids 3/15. R. E. Cannard, ch. engr.

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Ia., Des Moines — State, Des Moines, state office bldg. $3,500,000. Tinsley, Higgins & Lightner, Liberty Bldg., Des Moines, archts.

La., Reddel (near Eunice or Mamou)—Mill—Evangeline Textile Mills, Inc., Eunice, textile mill. **$2,000,000.**

New York—New York Housing Auth., 122 E. 42 St., New York Zone 17, Jefferson Park Housing, 900 dwelling units on site bounded by E. 111 and E. 114 Sts., First Ave., Manhattan Boro. **$12,000,000.** Primary recommended program — slum clearance site.

Ore., Eugene — University of Oregon, Eugene, plans by Lawrence, Tucker & Wallmann, Failing Bldg., Portland, science bldg. **$1,800,000;** business administration bldg., **$700,000;** heating plant and tunnel, **$1,000,000;** remodel old buildings, **$950,000;** women's gymnasium, **$700,000;** Condon and Chapman Halls addn., **$650,000;** administration bldg., **$600,000;** architectural and allied arts bldg., **$550,000;** school of journalism, **$500,000;** armory, **$300,000;** infirmary, **$225,000;** utilities addn., **$150,000;** men's gymnasium, **$150,000.**

Low Bidders & Contracts Awarded

Mo., Louisiana—Bureau of Mines, New Interior Bldg., Wash. 25, D. C., design and construction gas synthesis (Fisher-Tropsch Process) demonstration plant, near here, to Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa. **$4,413,250.**

Ohio, Columbus—Ohio State University, N. High St., general contract medical center bldg. on campus, to Grove, Shepherd, Wilson & Kruge, Inc., 247 Park Ave., New York 17, N. Y., Psaty & Fuhrman, 369 Lexington Ave., New York 17, N. Y., and Johnson, Drake & Piper, Terre Haute, Ind., **$4,576,700*****heating and ventilating and plumbing to Huffman-Wolfe Co., 669 N. High St., **$1,293,000** and **$653,900** respectively*****electrical work, to Electrical Contractors, Inc., 416 W. Erie St., Chicago, Ill., **$672,270.** Grand total **$7,195,870.**

Tenn., Nashville — Mantle Lamp Co., 223 W. Jackson St., Chicago, Ill., plans by Spencer J. Warwick & Assoc., 307 E. 4 St., Cincinnati, O., mfg. plant. **$4,000,000.**

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BOOK REVIEWS

Practical Electrical Wiring. By H. P. Richter. Published by McGraw-Hill Book Co, New York, N. Y. 574 pages, illustrated. Price $3.75.

This is the third edition of an established work, brought thoroughly up to date. In plain, easy language, it describes and explains methods of electrical wiring for the man who does the work. The book is in three parts: (1) fundamentals of electrical theory simply stated, and terminology; (2) wiring of residential buildings and farms; (3) wiring of non-residential structures, such as stores, schools and factories. The text on wiring is directly related to the provisions of the latest (1947) National Electrical Code and an appendix of Code tables is included.

Handbook of Engineering, Fourth Edition. By L. A. Waterbury. Published by John Wiley & Sons, Inc, New York, N. Y. 386 pages. Price $2.50.

This new edition of "Waterbury," revised by H. W. Reddick, W. M. Lansford, C. O. Mackey, H. H. Higbie, and H. S. Bull, brings up to date the material contained in previous editions. Much new data has been added. Included for the first time are the fundamental principles of heat transfer, the basic principles of illuminating engineering, and the fundamentals of mensuration.

Elements of Nomography. By R. D. Douglass and D. P. Adams. Published by McGraw-Hill Book Co, New York 18, N. Y. 209 pages, illustrated. Price $3.50

Gratifying effort has been made by these authors to break the drafting of the nomographic chart into consecutive stages, each isolated from the ensuing. The procedure should facilitate the novice in framing practical charts as well as choosing the most practicable type. Transformation and modifications of scale and displacement are made clear. Slant line, hexagonal, circular, compound and composite forms are treated after the simpler alinement forms have been developed. The book does not aim to present a collection of worked-out charts for reference.

Fluorescent Lighting Manual. By C. L. Amick. Published by McGraw-Hill Book Co., New York. 318 pages, illustrated. Price $4.

Revision of the 1942 book incorporates data on the new fluorescent lamps, auxiliaries and applications. As before there is comprehensive technical information about tube characteristics, ballasts, starters, operating behavior, hints on installations. Advice is given on servicing, maintenance, appropriate choice, use of lighting design data. A final chapter discusses comparative economics.

Corrosion Handbook. By H. H. Uhlig. Published by John Wiley & Sons, Inc, New York 16. 1188 pages, illustrated. Price $12.

Most of the worthwhile and authentic literature has evidently been collated for inclusion in this project of the Electrochemical Society. It represents the work of 104 specialists and is subdivided into sections on a functional basis. The opening third is devoted to the decadency characteristics of metals and alloys. Then follows the effects of corrosion and fouling from exposure to salt water, to soil, to high

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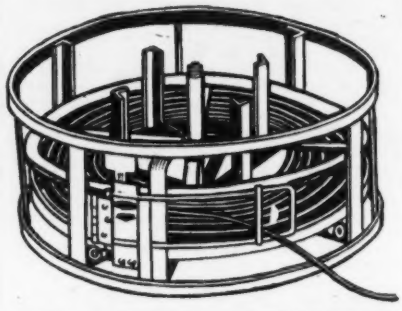

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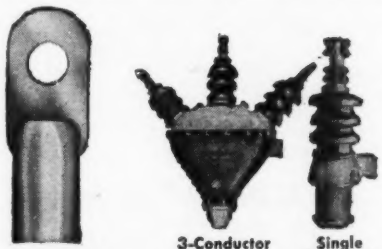

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temperature. In each instance and again more fully in a later corrosion-protection section there is quantitative discussion of the means of thwarting corrosion by coating, by inhibition or by anodic or cathodic procedures. In another functional classification are found treatments of cable sheaths, pipes, steam boilers and condensers, water modification, stray currents.

Fractional Horsepower Electric Motors. **By C. G. Veinott. Published by McGraw-Hill Book Co, Inc, New York 18, 554 pages, illustrated. Price $5.**

Approximately one-third of the original material is completely recast in this second edition. Further effort has been made to keep the pages as specifically useful as possible to the applier and the repairers of small motors. Reference to the ASA, NEMA and AIEE standards have been revised to conform to the intervening changes. Other modernizations pertain to electrolytic capacitors, shaded-pole motors, hysteresis and inductor motors, and wartime forms of self-synchronous motors.

Electronic Transformers and Circuits. **By Reuben Lee. Published by John Wiley & Sons, Inc, New York, N. Y. 282 pages, illustrated. Price $4.50.**

A text on design of transformers for and their adaptation to electronic circuits, the book starts with construction details and performance criteria before adverting to voltage doublers, filament transformers, reactors, rectifiers and amplifiers. One particularly helpful chapter is that dealing with amplification circuits and wave filters in the light of transformer and tube characteristics. Closing sections deal with transformers for electronic control and for video and pulsed microwave application.

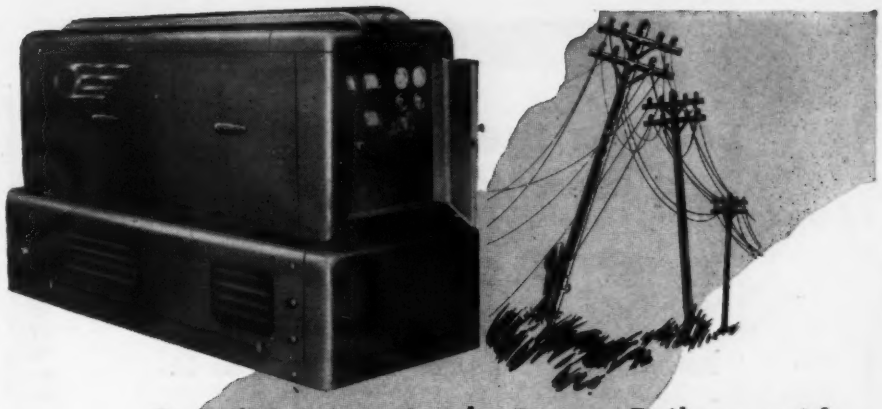
Vacuum-tube Circuits. **By L. B. Arguimbau. Published by John Wiley & Sons, Inc, New York (16). 668 pages, illustrated. Price $6.00.**

Focus here is, as implied, on the circuits rather than on the tubes. However, the tube characteristics are correlated with the circuit characteristics so that one can derive an adequate understanding of the reasons why particular combinations of capacitors, resistors and inductors are required to achieve desired performance. Particular stress is placed on the method of reasoning by which the values are fixed. With this established the author goes on to analyze power amplification, feedback, sidebands, frequency multipliers, oscillators, intermediate frequency amplification, AVC, frequency modulation, interference and regeneration. Closing chapters deal with pulses, television, microwaves and Klystrons.

Power System Stability. I **By E. W. Kimbark. Published by John Wiley & Sons, Inc, New York (16). 355 pages, illustrated. Price $6.00.**

Professor Kimbark's practical experience with power system analyses imparts to this introductory volume a leavening of the academic factors which is helpful to the power system engineer. For example, there are simple explainations of the per-unit procedure for computing impedances, how a.c. boards are used in system studies, how the more laborious computations would be organized, the effect of fault-clearing time and the technique of simplifying and representing short-circuits and ground faults. Volume I closes with the essence of four typical system stability problems.

Volume II will deal with protective systems; Volume III will be a more penetrative treatment of the field of the present Volume I.



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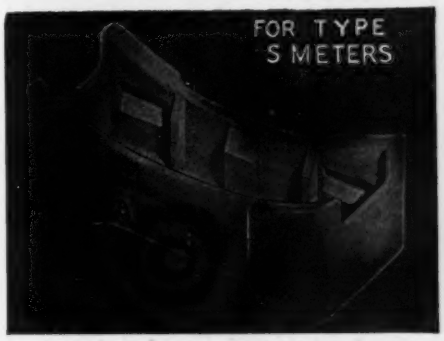

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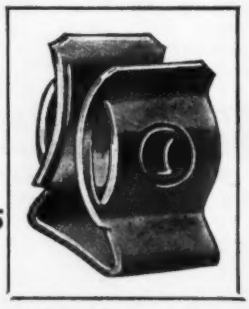

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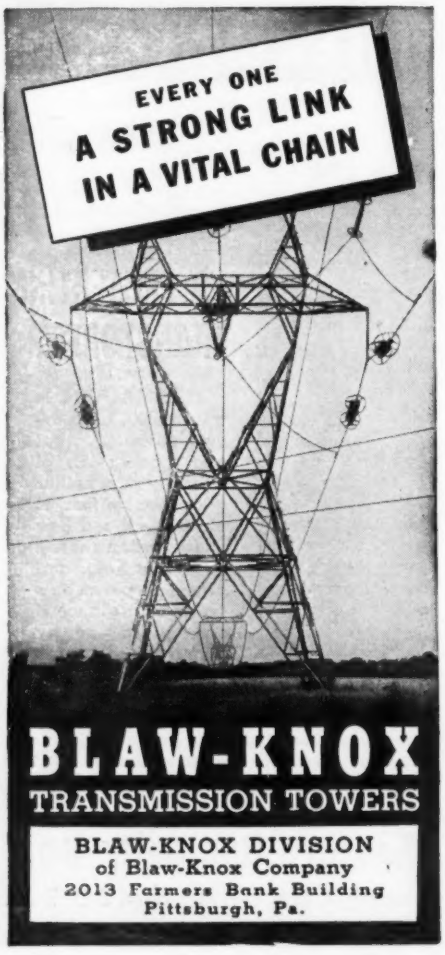

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TECHNICAL LITERATURE

Aluminum—A revised system of aluminum alloy temper designations has been developed and is based on manufacturing techniques. The nomenclature system, effective Jan 1, 1948, is presented in a 16-page booklet "Alcoa Temper Designations for Cast and Wrought Products" issued by Aluminum Co of America, Pittsburgh 19, Pa.

Insulation Tests—Directions for making insulation resistance tests; instructions for connecting and operating the Megger instrument, supplementary instructions and explanations for interpreting tests are included in an instruction manual for the use of Megger insulation testers. The publication is obtainable, price 50 cents, from James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

Canadian Standards—Following five publications have been issued by the Canadian Standards Association, National Research Building, Ottawa, Ont.; prices indicated.

Standard C22.1-1947, Canadian Electrical Code, Part I, covers electrical installations for buildings, structures and premises. Price $1.

Standard C22.3 No. 1(C)-1947, Canadian Electrical Code, Part III, covers construction of overhead supply lines crossing communication lines. Price $1.

Standard C22.4 No. 108-1947, Canadian Electrical Code, Part IV, "Construction and Application of suppressors for radio interference." Price 10 cents.

Standard Specification W47-1947, "Welding Qualification Code for the Application to Fabricating and Contracting Firms, Their Welding Personnel and Equipment." Price 75 cents.

Standard Specification W48-1947, "Iron and Steel Arc-Welding Electrodes." Price 75 cents.

Ceramic Materials — Physical properties and general applications of the following dielectric ceramics, Steatite, high-voltage porcelain, Cordierite, Zircon porcelain, alumina, titanium dioxide and titanates, and light duty refractories, are presented in a booklet "Special Ceramic Materials and Their Industrial Applications" furnished by General Ceramics and Steatite Corp, Keasbey, N. J.

The Cherokee Project—That is the title of Technical Report No. 7 announced by the Tennessee Valley Authority and procurable from Superintendent of Documents, Washington, D. C., at $1.50 per copy. The 411-page publication has 138 illustrations and covers the planning, design, construction and initial operations of the Cherokee Dam and Reservoir.

Insulating Materials—The 1947 compilation of ASTM Standards on Electrical Insulating Materials aggregates 580 pages, and gives in their latest form some 90 specifications and tests covering a wide range of materials in this field. A detailed index is included. The book with paper covers is available at $4 per copy from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

Porcelain Insulators—A listing of commonly used manufacturing processes in making porcelain insulators, and typical sizes and shapes with limitations are outlined in Locke Engineering Data Folder No. 1. The 8-page publication may be obtained from Locke Insulator Corp, P. O. Box 57, Baltimore 3, Maryland.

Steel Strip—Definitions, glossary, quality classifications, inspection, mechanical testing procedures and some metallurgical aspects for hot-rolled carbon steel strip are presented in Section 12 of the Steel Products Manual. The booklet is obtainable from American Iron and Steel Institute, 350 Fifth Ave, New York 1, N. Y.

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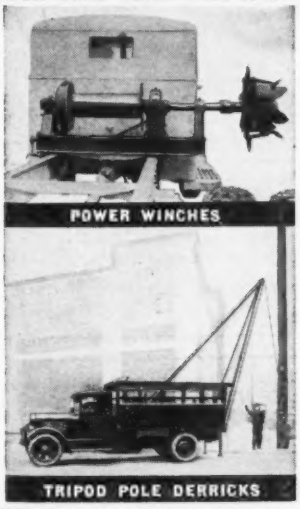

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CATALOGS • BULLETINS

●THERMOCOUPLES: In addition to description, Bulletin P1235 contains a chart and engineering data on selecting thermocouples and protection tubes. Bristol Co, Waterbury 91, Conn.

●SWITCHING EQUIPMENT: Catalog 11 presents technical and application data, specifications, numerous illustrations, subject and catalog number indexes of bus and ground fittings, terminals, indoor and outdoor switches and bus supports, line hardware and motor mechanisms. Royal Electric Mfg Co, 1122 East 87th St, Chicago 19, Ill.

●SPEED REDUCERS: Descriptions and illustrations are given in Bulletin 10,000 covering Motoreducers, high speed drives, couplings and special gear drives. The Falk Corporation, 3060 West Canal St, Milwaukee, Wis.

●CONNECTORS: In bulletin 48Y1 beryllium copper-lined Hysplices are described and sizes listed for copper, copperweld, full tension and loop service, and ACSR loop service. Burndy Engineering Co, Inc, 107 Bruckner Blvd., New York 54, N. Y.

●TOOL BUCKETS: Collapsible canvas tool buckets and insulated tool bags for transmission line work are described and illustrated in a 4-page bulletin. Industrial Products Co, 2820 North Fourth St, Philadelphia 33, Pa.

●FURNACES: Bulletin 120 outlines a combination carburizing and isothermal heat treat process. Ajax Electric Co, Inc, Frankford and Delaware Ave, Philadelphia 23, Pa.

●PUMPS: Description, performance and specifications are contained in bulletin U-47 covering portable 1½ to 3-in. self-priming centrifugal aluminum pumps, engine driven, for manhole and other utility maintenance work. Marlow Pumps, 218 Greenwood Ave, Ridgewood, N. J.

●ARMOR RODS: A 14-page booklet contains application data on preformed armor rods for following conductors: ACSR, Amerductor, Copper, Copperweld and Copperweld-Copper. Performed Line Products Co, Dept 813, 609 Buckley Bldg, Cleveland 15, Ohio.

●MOTORS: Totally enclosed, fan-cooled squirrel cage motors in sizes 250 to 500 hp, 3600 rpm for direct drive are described in Bulletin NAF-1. Burke Electric Co, 273 W. 12th, Erie, Pa.

●POWDER METAL: Powder metal parts and bearings, slipring and commutator brushes and negative temperature coefficient resistance units are described in a 4-page folder. Keystone Carbon Co, 1935 State St, St. Marys, Pa.

●INSTRUMENTS: Catalog 48 lists portable test, electronic panel and switchboard instruments, pyrometers, analyzers, transformers, voltage regulators, controls and other accessories. Electro-Tech Equipment Co, 117 Lafayette St, New York 13, N Y.

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